

MicroLink™ 56k i

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Preface

Thank you for placing your trust in this devolo product.

With the MicroLink 56k i you have chosen a modem which will permit you to take advantage of the new 56k technology. In addition, the MicroLink 56k i is equipped with the AT command circuit according to V.250/V.253.

Exacting manufacturing standards and stringent quality control are the basis for high product standards and consistent quality to ensure your fullest satisfaction with this modem.

About this manual

This manual will inform you about all aspects of your MicroLink 56k i. In addition, a brief overview and a detailed description of the AT commands are provided.

Changes to this manual

devolo products are characterized by ongoing further development. It is therefore possible that the information printed in this manual is not current in all points.

Additional information in the Internet at 'www.devolo.de'.

Our online services www.devolo.de are available to you around the clock should you have any queries regarding the MicroLink 56k i.

Package contents

Please ensure that the delivery is complete before beginning with the installation of your modem:

- MicroLink 56k i
- Power adapter
- Telephone line connection cable
- Modem connector cable (V.24/RS232 cable)
- Adapter (D-Sub9/D-Sub25)
- CD-ROM with drivers and user manual
- User manual (in print)

devolo reserves the right to change the package contents without prior notice.





CE conformity

This product meets the requirements of the 1999/5/EG Directive (R&TTE) and is designed for connection to public telecommunications networks in the EU and Switzerland.

Connect the device to the public telecommunications network with the supplied cable.

The declaration of conformity with the basic requirements can be found in the appendix of this manual.

Hints for CE conformity

In some cases your modem can negotiate a lower data transmission rate during extreme electromagnetic disturbance. This occurs in order to reduce the risk of incorrect data communication. Maintenance of an existing data link can nevertheless in most cases be ensured.

As soon as the disturbance is reduced or removed, your MicroLink 56k i negotiates a higher data transmission rate again.

Contents

1 Introduction	6
1.1 Installation	6
1.2 Highlights of the MicroLink 56k i	6
2 Control commands	9
2.1 Entering and executing AT commands	9
2.1.1 Escape command	9
2.2 Bit-oriented registers	10
2.2.1 Modifying bit-oriented registers	10
2.3 Overview of AT command set and registers	10
2.3.1 Basic control features	11
2.3.2 Extended control features	12
2.4 Overview of the 'AT' and 'AT+' command set	12
3 AT commands: Detailed description	17
3.1 Labeling of the default configuration	17
3.2 Extended command set	44
3.2.1 'AT+' command set	44
4 Description of registers	62
5 Description of messages	82
5.1 Commands with effect on messages	82
6 Appendix	87
6.1 Status display and troubleshooting	87
6.2 Technical data	88
6.3 Declaration of conformity	91
6.4 Warranty conditions	92

1

Introduction

MicroLink 56k i is an external desktop model housed in a robust flat aluminum case. The hardware installation is fast and user-friendly thanks to plug&play support.

The manufactured modem MicroLink 56k i is delivered as integrated sub-components of an entire system. If the system should not yet be installed, please establish the following connections.

1.1

Installation

- ① Connection of the modem to the power supply
- ② Connection of the modem to the serial interface of the computer
- ③ Connection of the modem to a telephone socket
- ④ Please insert the supplied devolo product CD into your CD-ROM drive.
- ⑤ To install the driver, please follow the instructions of the hardware wizard.



The MicroLink 56k i driver contains information (e. g. device name, connecting messages, initialization commands) for your Windows operating system. It could also be found in the download area of our homepage www.devolo.de. In case you need more information, please refer to the system documentation.

1.2

Highlights of the MicroLink 56k i

The following is an outline of the essential technical features of the modem to provide a quick overview of its functionality:

- **Transfer rates** – MicroLink 56k i supports the following transfer rates and velocities:
 - V.90: 28,000 to 56,000 bps (only receive bit rate)
 - K56flex: V.: 28,000 to 56,000 bps (only receive bit rate)
 - V.34: 2400 to 33,600 bps, duplex
 - V.32bis: 4800 to 14,400 bps, duplex
 - V.32: 4800 to 9600 bps, duplex
 - V.22bis: 1200 to 2400 bps, duplex

- V.23: 1200 bps, half duplex; 75/1200 bps, duplex; 1200/75 bps, duplex
- Bell 212A: 1200 bps, duplex
- V.21: 300 bps, duplex
- Bell 103: 300 bps, duplex
- **V.90** – Standard of the international ITU standardization committee for the transmission of 56K modems.
- **Fax operation** – In addition to the types of modem operation, the MicroLink 56k i supports fax transmission and reception with speeds of 2,400 to 14,400 bps. By using the fax commands Class 1, Class 1.0, Class 2, Class 2.0 and Class 2.1, the use of any desired standard fax software is possible.
- **Fax polling** – The modem supports fax polling. The unit, together with suitable fax software, can be used for fax polling or for the operation of a polling system.
- **Answering machine function** – With a suitable voice software, MicroLink 56k i can be used as an answering machine.
- **Access protection, callback function, and remote configuration** – The access protection is intended to protect your modem against the use or configuration by unauthorized modem users. With the help of a password, the so-called supervisor password, specific modem functions can be blocked. A total of 5 access keys can be used in order to establish access authorization to the modem.
 - The callback function allows an automatic callback of the called modem. A total of 19 callback numbers with respective passwords can be stored.
 - The remote configuration allows you to configure your modem from any location you are calling from and can be combined with the automatic callback function.
- **Error correction** – The MNP4 and V.42 error correction protocols implemented in the modems guarantee a 100% error-free data transmission even with poor telephone connections. MicroLink 56k i with MNP4 or V.42, reliable, error-free connections can be established with other similarly equipped modems.
- **Data compression** – MicroLink 56k i contains the MNP5 and V.42bis data compression procedure. By using MNP5, the transfer rate can be increased up to factor 2, and up to factor 4 with V.42bis.

- **AT command language** – When communicating with MicroLink 56k i, the AT command set is used according to V.250/V.253.
- **Flash ROM technology** – With the help of flash ROM technology, firmware updates can be implemented quickly and easily.
- **Warranty** – three years warranty for the MicroLink 56k i
- **Protected** – The MicroLink 56k i satisfies the CE requirements.

2

Control commands

The AT command set (AT = command prefix for Attention) was not standardized until recently. The implementation was left to the discretion of the individual manufacturers. A standard now exists in the V.250/V.253 command set.

With your MicroLink 56k i, you have purchased a state-of-the-art modem equipped with the AT command set in accordance with V.250/V.253.

A terminal program is required to enter AT commands via a PC.

2.1

Entering and executing AT commands

After switching on, the modem is in the command phase. Commands can only be accepted, interpreted and executed in this phase.

In the event that several commands are to be sent to the modem, these may be entered individually, each with an AT command prefix and a concluding . It is also possible, however, to enter these commands consecutively in a single command line after an introductory **AT** and to conclude the line with an .

The individual commands may be separated by spaces to improve the overview. No further characters may be entered once the end of the command line buffer has been reached. The command line can then only be edited with (backspace) or executed with .

2.1.1

Escape command

Use the characters and to abort a command line or a screen output (e.g. in case of displaying the register contents use **AT%R**).

Commands that must be specified with a parameter may also be entered without a parameter. The absence of a parameter corresponds to the parameter 0 (e.g. **ATL = ATL0**).

After the successful establishment of a connection to the remote site, the modem switches from the command phase to the transfer phase.

Transfer phase means that a connection to a remote data station (i.e. to another modem) exists: The modem is "online". This is the case after successful call establishment (outgoing call), as well as after answering a call

(incoming call). The exchange of data between two data stations can take place during this phase.

A renewed transition to the command phase and back, also in the case of an existing connection, is possible with the escape command and the command **ATO**. The escape command consists of a series of three escape characters (default setting: `+++`) and a valid command line.

After the three escape characters have been entered, the modem is in the command state. Data transfer is not interrupted until a valid command line has been recognized.

The escape character has nothing in common with the character `[Esc]` of the ASCII character set. It can be redefined in register S2.

All commands sent to the modem must begin with the ASCII characters **AT** or **at** (not valid: `At` or `aT`) and must be concluded with `[Enter]`. A valid command line in an escape sequence is restricted to a maximum of 40 characters.

The command **AT&F** loads the firmware default parameter settings. This command is not executed during existing connections.

2.2 Bit-oriented registers

Bit-oriented registers are primarily used to provide status information. Please note that the modification of a single value in the bit-oriented register may have several functions. Great caution should thus be applied when changing bit-oriented registers! To change the configuration of your modem, you should use the AT commands instead. A complete description of the S registers can be found in the chapter 'AT commands: Detailed description'.

2.2.1 Modifying bit-oriented registers

The following example will illustrate the modification of the bit-oriented options of a register. To set the bit 6 of register S14, enter the command **ATS14.6=1**.

If you would like this value to be maintained after the modem is switched off, the new entry can be stored with the command **AT*W**.

2.3 Overview of AT command set and registers

In this brief overview, which is grouped according to topics, you find frequently needed AT commands and registers you can use to change your

modem settings. The “Commands and registers” column lists AT commands and registers you can use to change the basic settings of the modem. The “More commands and registers” column lists AT commands and registers for extended control of the modem.

2.3.1

Basic control features

Configuration	Commands and registers	More commands and registers
Basic initialization of the modem	AT&F	
Control of call establishment (dialing)	ATD, ATP, ATT, ATX	AT\$D, AT:D, S6, S7, S8, S14 (bit 6)
Call acceptance, taking over of the line, hang up	ATA, ATD, ATH, AT&D2, S0	AT-H, AT\T, S14.6, S28 (bit 7)
Transition between command and transfer phase	+++ , ATO	S2
Control of speaker and of call signaling	ATL, ATM, AT\$JRING	
Read out modem information	ATI, ATS, AT&V, AT#UD	AT%R, AT\S, AT%V, S86, \$CS
Control data compression	AT+DS	
Control error correction	AT+ES	
Control data flow monitoring	AT+IFC	
Control dial lock or dial delay	S31 (Bit 7)	

2.3.2

Extended control features

Configuration	Commands and registers	More commands and registers
Operation with saved initializations	AT&V, AT&W, AT*W, AT&Y, ATZ	
Operate with saved phone numbers	AT+ASTO	
Protected access and callback	AT\$B, AT\$Y, AT\$S, AT\$P, AT\$R	S35, S42, S43, S53
Remote configuration	AT*E, AT*U, AT*X	S34
Special control features		
Control modem signal lines	AT&C	AT&D, AT&S
Control the effects of DTR	AT&D	AT\$D, AT&D, S28 (bit 7)
Control modem answers	ATE, ATQ, ATV, ATV	AT&D, AT-H, AT-M, AT*Q, S96
Control call tones	AT&G	
Control modulation method	AT+MS	
Control data format	S28 (bit 0-1), S53	
Control telephone-side speed	AT+MS	

2.4

Overview of the 'AT' and 'AT+' command set

A complete description of the AT command set can be found in the chapter 'AT commands: Detailed description'.

Command	Meaning
A	Answering an incoming call
%A	Fallback character in the negotiation phase
+A8E	V.8 and V.8bis operation control
+ASTO	Store speed-dial numbers

Command	Meaning
\$B0 \$B1 \$B2	No callback RING and CONNECT are displayed before the access procedure RING and CONNECT are displayed after the access procedure
\C0 \C1 \C2	No data buffering in the negotiation phase Data buffering in the negotiation phase No data buffering, fallback character recognition (AT%A)
&C0 &C1	DCD is always active DCD displays existing carrier
\$CS	Query of the current modem settings
D	Establishing a connection
\$D0 \$D1	Disables DTR dialing Enables DTR dialing
&D0 &D1 &D2 &D3	Ignore transition of DTR status Switch to command phase if DTR ON ? OFF Abort connection if DTR ON ? OFF Abort connection and reinitialize if DTR ON ? OFF
:D0 :D1	Modem does not go online if DTR OFF ? ON Modem goes online if DTR OFF ? ON
\D0 \D1 \D2 \D3	DSR and CTS always active DSR shows answering tone and CTS is always ON DSR always active and CTS tracks DCD DSR shows answering tone and, CTS follows DCD
+DR	Display data compression method
+DS	Select data compression method
E0 E1	Commands not echoed Commands echoed
%E0 %E1	Automatic retrain OFF Automatic retrain ON
*E0 *E1	Remote configuration OFF Remote configuration ON
+EFCS	FCS operation in V.42 mode
+ER	Display error correction method
+ES	Select error correction method
+ETBM	Buffer handling after disconnect
&F	Load default configuration
+GCI	Country Selection

Command	Meaning
+GMI	Display company name
+GMM	Display product name
+GMR	Display version number
+GSN	Display serial number
&G0	Calling tone on, no guard tone
&G1	Calling tone on, guard tone 550 Hz
&G2	Calling tone on, guard tone 1800 Hz
&G4	Calling tone off, no guard tone
&G5	Calling tone off, guard tone 550 Hz
&G6	Calling tone off, guard tone 1800 Hz
H0	Terminating an existing call
H1	Go off-hook
-H0	Normal operation
-H1	Dumb mode
I0	Report product code in nnn format
I1	Report checksum
I3	Report version number and release date
I4	Display of current parameters
I6	Display product name
I9	Plug&play
I11	Report self-test result
L0	Low speaker volume
L1	Low speaker volume
L2	Medium speaker volume
L3	High speaker volume
+IFC	Data flow control on serial interface
+ILRR	Display of current interface speed
+IPR	Display of computer bit rate recognition setting ('0' = AUTO)
M0	Speaker always off
M1	Speaker on during call establishment
M2	Speaker always on
M3	Speaker on while waiting for answer tone (outgoing call)
-M0	Plain text CONNECT messages dependent on ATV
-M1	Plain text CONNECT messages independent of ATV
O0	Transition to online status
O1	Return to online state with retrain
+MR	Display of modulation procedure and the telephone bit rate

Command	Meaning
+MS	Selection of the modulation procedure and the connection bit rate
P	Pulse dialing
\$P	Enter and save user password and callback number
Q0	Return of messages from modem ON
Q1	Return of messages from modem OFF
Q2	Messages off in answer mode
*Q0	CONNECT message after invalid escape sequence
*Q1	No CONNECT message after invalid escape sequence
%R	Display register contents
\$R	Display user password and parameters
S	Set and read the internal register
&S	Importance of DSR
\S	Verbose display of the current configuration
\$S	Set access keys
\$S?	Query of current access keys
T	Frequency selection method
&T0	Normal operation
&T1	Enable local digital loopback
&T3	Enable remote digital loopback
&T4	Remote digital loopback accepted
&T5	Remote digital loopback blocked
&T6	Enable remote digital loopback
\T	Inactivity timer
\$T0	Trace mode OFF
\$T1	Trace mode ON
*U	Save current configuration
V0	Messages in short form as a digit
V1	Messages in plain text
%V	Display of firmware version
&V	Display configuration profiles
\V0	No modified CONNECT messages
\V1	Identification of error-free connections
\V2	Identification of MNP, V.and V.42bis connections
\V8	Identification of MNP, V.42 and V.42bis connections

Command	Meaning
&W0	Save extended configuration profile 0
&W1	Save extended configuration profile 1
*W0	Save extended configuration profile 0
*W1	Save extended configuration profile 1
X0	Ignore dial tone/ignore busy tone
X1	Ignore dial tone/busy tone
X2	Wait for dial tone/ignore busy tone
X3	Ignore dial tone / evaluate busy tone
X4	Wait for dial tone / evaluate busy tone
*X	End remote configuration
&Y0	Set pointer to configuration profile 0
&Y1	Set pointer to configuration profile 1
\$Y	Change supervisor password
Z0	Load configuration profile 0
Z1	Load configuration profile 1
.	Setting and reading of a bit in a register

3 AT commands: Detailed description

3.1 Labeling of the default configuration

The * character marks the default AT command settings. The standard values of the individual register bits are marked in bold type.

A Answer incoming call

ATA

Incoming calls can be answered using this command. An incoming call is indicated by the line RI = ON and, unless the modem result codes are disabled, reported by the message RING (verbose form) or 2 (abbreviated form).

If the automatic call acceptance function is enabled, a call cannot be accepted manually (i.e. with the **ATA** command) as the line is disconnected upon the entry of any character except for line feed (see register S0, page 62). Call establishment is not aborted, however, if bit 6 of register S14 has been set to 1 (default = 0). This setting permits the attached computer to send characters to the modem during call establishment.

Furthermore, this command allows an existing telephone connection (voice) to be taken over by the modem (data). This requires that modem and telephone are connected to the same line (see also **ATD** command, page 21).

Example

A telephone connection is established. The parties agree on a transmission format, transmission protocol etc. The change to the online state takes place by entry of **ATA** by the one party and subsequent entry of **ATD** by the other party. The parties must also agree on which command is to be given on which side.

%A Fallback character in the negotiation phase

AT%An (n = 0..62, 64..125, 127; default = 0)

This command defines the character that is regarded as fallback command during call acceptance. **AT\C2** and **AT+ES=3,0** or **AT+ES=,,2** (refer to page 19 and 48), respectively, have to be set for this command.

If the modem receives this character in the negotiation phase while trying to establish an error-corrected connection (setting **AT+ES=3,0** or **AT+ES=,,2**), it falls back to normal mode immediately. The fallback character is not passed to the serial port. As soon as the modem receives a SYN character (22 decimal), the fallback character recognition is switched off. The default setting 0 disables the fallback character recognition entirely.

\$B

Activate password protection and automatic callback

***AT\$B0 : No callback**

AT\$B1 : RING and CONNECT are displayed before the access procedure

AT\$B2 : RING and CONNECT are displayed after the access procedure

If your modem is used by several persons, you can use the password protection to restrict the access to your modem. Five so-called access flags can be used to define which modem functions may be used.

The automatic callback feature with password protection enables your modem to call another modem back automatically after it has been called.

The **AT\$B0** command disables the callback function.

The **AT\$B1** command (version 1) determines that the RING and CONNECT messages are displayed before the access procedure.

The **AT\$B2** command (version 2) determines that the RING and CONNECT messages are displayed after the access procedure. If a proper connection has been established, the input of an ATD command is followed by a CONNECT message. This setting, however, allows the best matching for call establishment without password protection.

After establishing the connection, the modem does not immediately enter the transparent mode, but activates its callback routine. This routine prompts the

Example

user at the remote modem to identify himself by entering his user password and (if configured accordingly) his phone number.

MicroLink 56k i

password *****

PHONE NUMBER:*****

password OK

If the entries are correct, the message 'password OK' is displayed, and the called modem immediately terminates the connection. After the time set in register S43 (see page 71), the phone number stored along with the user password is called automatically. The modem will not enter the transparent mode before the remote user has entered his user password and (if configured accordingly) his phone number again. If the user does not enter a valid identification within the time defined in register S42, the called modem terminates the connection.

If the callback function is disabled, the modem immediately establishes a transparent connection.

\C

No data buffering in the negotiation phase

***AT\C0 : No data buffering in the negotiation phase**

AT\C1 : Data buffering in the negotiation phase

AT\C2 : No data buffering, fallback character recognition (AT%A)

During a call acceptance with the setting **AT+ES=3,0** or **AT+ES=,2** command determines how the modem treats characters that are neither an MNP nor an LAPM request.

If no MNP or LAPM request is recognized within three seconds, the modem falls back to normal mode. In the setting **AT\C0**, no buffering and no early fallback takes place.

In the setting **AT\C1**, up to 200 characters can be buffered additionally that are sent to the port after the fallback to normal mode. If 200 characters are

received before the three seconds have elapsed, the modem falls back immediately.

In the setting **ATC2**, the fallback to normal mode can be triggered by the character defined with the **AT%A** command. No buffering takes place. This can be used to shorten the negotiation phase when the calling modem does not support error correction.

&C Significance of DCD

AT&C0 : DCD is always active

***AT&C1 : DCD displays existing carrier**

Communication programs usually evaluate the DCD line in order to check for an existing data connection. The modem supports this function with the setting **AT&C1**.

\$CS Query of the current modem settings

AT\$CS=<command group>,<number of lines>

This command is used to query all current settings of the modem. The output is sorted according to command groups. You can set the number of lines to be output via the monitor. The following settings are valid:

Parameter	Value	Description
Command group	+A, +G, +M, +E, +I, +D, +F, +V, #V, \$J	Display of the command group in question
	ALL	Display of the entire command set
Number of lines	1-40	Set number of lines to be output
	0	Output of all lines of the command group

Example

If you enter the following command, the modem output will look like this:

at\$cs=+g,3

+GCI: 04
+GMI: "ELSA AG, Aachen (Germany)"
+GMM: "MicroLink 56k i"
Continue by clicking on desired key
+GMR: "xxxxxxxxx"
+GSN: "xxxxxxxxx"
OK

D Establishing a connection

ATDn

Upon an ATD command, the modem attempts to establish a connection and dials the telephone number 'n'. 'n' can consist of the digits 0..9 and, in the case of tone dialing, may also contain the characters A..D, * and #. The maximum allowed length of the entire dial string is 36 characters.

The connection establishment can be aborted at any time during dialing by entering any character, except for Line Feed, XON and XOFF. In addition, entry of **ATD** without parameters allows an existing telephone connection (voice) to be taken over by the modem (data). This requires that modem and telephone are connected to the same line. The following special characters may be included:

Special characters	Description
P	Dialing method Pulse dialing from this point on
T	Tone dialing from this point on
!, & or [External call Press flash button (only for tone dialing)
W or :	Wait for dial tone Wait for (second) dial tone. No wait for the dial tone before dialing the first number, regardless of the ATX setting.
@	The modem pauses for 6 seconds, maximum time is set according to register S7 (in Switzerland 10 second pause).

Special characters	Description
,	Dial pause Dial pause as defined in register S8
<	Dial pause 1 second
=	Dial pause 3 seconds
L	Dialing of stored telephone numbers Redial
S=m	Dial the number stored with AT+ASTO at location m
;	Remain in command mode after dial string (for the addition of further dialing commands in the event of excessively long dial strings)

Example

A modem is called up by telephone. As soon as the remote modem sends an answer tone, a modem connected to the same line as the telephone can take over the line with the **ATD** Enter command (see also **ATA** command, page 17).



*In general, special characters can be inserted at any point of the dial string and are effective beyond that point. The special characters for dialing stored numbers are an exception (see the **AT+ASTO** command, page 45.) These special characters must be entered directly after **ATD**. The **;** character for appending additional dial commands must be located at the end of a dial string.*

\$D

Automatic Dialing with DTR

***AT\$D0** : Disables DTR dialing

AT\$D1 : Enables DTR dialing

If DTR dialing is on (**AT\$D1**) and the status of the DTR control line changes from OFF to ON, the modem will establish a connection with the number stored on position 0.

&D

Effect of DTR

AT&D0 : Ignore transition of DTR status

AT&D1 : Switch to command phase if DTR → OFF

***AT&D2 : Abort connection if DTR → OFF**

AT&D3 : Abort connection and reinitialize if DTR → OFF

These commands determine how the modem reacts to a transition of the DTR interface line from ON to OFF.

When set to **AT&D0**, the modem ignores the state of the DTR line.

With **AT&D1**, the transition of the DTR control line from ON to OFF has the following effects: If the modem is in the command phase, the transition has no effect. During the establishment of a connection, the ON to OFF DTR transition aborts the connection. If the modem is in the transmission phase (i.e. with an existing connection), it will switch to the command phase.

With **AT&D2**, the transition of the DTR control line from ON to OFF has the following effects: If the modem is in the command phase, the transition has no effect. During the establishment of a connection, the ON to OFF DTR transition aborts the connection. Call acceptance is not possible again before DTR returns from OFF to ON.

With **AT&D3** the modem's response is the same as with **AT&D2**. In addition, the modem is reinitialized by the DTR transition from ON to OFF (see also **ATZ** and **AT&Y**).

The modem does not report a RING with **AT&D2** and **AT&D3** if DTR is set to OFF. Automatic call answering is not possible until after the DTR transition from OFF to ON. A RING message with subsequent call answering can be enabled despite DTR = OFF by setting bit 7 in register S28.

:D

Manual dialing

***AT:D0 : Modem does not go online if DTR OFF → ON**

AT:D1 : Modem goes online if DTR OFF → ON

After a connection has been established manually (by telephone), the modem goes online with the setting **AT:D1** when the DTR interface line changes from OFF to ON. It does not do so with the standard setting **AT:D0**.

VD

DSR/CTS control

- *ATVD0** : DSR and CTS are always ON
- ATVD1** : DSR shows answering tone and CTS is always ON
- ATVD2** : DSR is always On and CTS shows DCD
- ATVD3** : DSR shows answering tone and, CTS follows DCD

With this command, the importance of DSR and CTS control circuits is affected. If a hardware data flow control is installed, the adjustment of the **ATVD** command for the CTS control circuit is not important.

E

No command echo to host

- ATE0** : Commands not echoed
- *ATE1** : Commands echoed

This command selects whether your modem echoes entered commands on the local screen or not.

If the echo is switched on and all characters appear twice on your monitor, your communications program is in half-duplex mode, and you should switch to full duplex mode.



%E

Disable automatic retrain

- AT%E0** : Automatic retrain off
- *AT%E1** : Enable automatic retrain

If the modem is set to **AT%E0** no retrain is performed even if the line quality is poor. With the default setting **AT%E1**, the modem automatically tries to adapt itself to changes of the line quality.

If the automatic retrain is disabled with **AT%E0**, a retrain can nevertheless be triggered manually by changing to the command state in an existing connection and entering **AT01** (see page 30).

*E

Enable remote configuration


***AT%E0 : Remote configuration off**

AT%E1 : Remote configuration on

The remote configuration allows you to configure your modem from any location you are calling from and can be combined with the automatic callback function. Up to 19 different user passwords can be stored with the **AT\$P** command (see page 30).

Remote configuration is switched off with the **AT%E0** command and activated with the **AT%E1** command.

When a connection has been established, the modem is in the online state as usual. However, once the configuration command is entered, which consists of four characters (default setting: ****, see also register S34, page 70), followed by a valid command line, the modem enters the configuration mode. This allows the modem to temporarily leave the online transmission without aborting the connection.

The configuration command is only recognized in the online transmission command state. A valid command line must start with AT or at and ended with an .



The user at the remote modem is prompted to identify himself by entering his user password. If his entries are correct, the message 'password OK' is displayed, and the remote configuration is active.

If the remote configuration is used in combination with the automatic callback function with password protection, the password is requested directly after the connection establishment, and therefore the remote configuration becomes active immediately after the valid configuration command.

Example

MicroLink 56k i

password *****

password OK

REMOTE CONFIGURATION ON

OK

>The prompt (>) indicates that you are in configuration mode. Locked commands are answered with *ERROR*.



&F

Load default configuration

AT&F

This is used to load the firmware's default parameter settings. (Exception: S54, S64, S86, S87, S88, S89, S99, S130 and S229 are not changed). This command is not executed during existing connections.

&G

Set calling tone and guard tone

- *AT&G0 : Calling tone on, no guard tone**
- AT&G1 : Calling tone on, guard tone 550 Hz**
- AT&G2 : Calling tone on, guard tone 1800 Hz**
- AT&G4 : Calling tone off, no guard tone**
- AT&G5 : Calling tone off, guard tone 550 Hz**
- AT&G6 : Calling tone off, guard tone 1800 Hz**

The guard tone is an additional signal that can be sent over the telephone line in V.22bis mode. It is sent by the answering modem as long as the connection is active. This tone is not relevant in countries in which devolo modems are approved by the national telecommunications service. The frequency of the guard tone cannot be modified in modem versions approved in Austria. It is either set to 1800 Hz or off.

The calling tone is a periodic tone that is transmitted in the time period between dialing and connection. As this tone can lead to disturbances in some foreign modems, it is possible to suppress the transmission of the calling tone.

H Hang up/switch modem on

ATH0 : Hang up

ATH1 : Go off-hook

The command **ATH0** is used to hang up an existing connection if the modem is in the command mode after an escape command or a DTR transition from ON to OFF with a preceding **AT&D1** (refer to page 22).

If the modem is offline, it can be told to go off-hook (pick up the phone) with the **ATH1** command. The modem holds the line for a maximum of 255 seconds before hanging up.

This command must be located in the last position of a command line (i.e. subsequent commands are not executed).

-H Dumb mode

***AT-H0** : Normal operation

AT-H1 : Dumb mode

The **AT-H1** command can be used to set the modem into the dumb mode. This means that an incoming call will always be answered as soon as the DTR line is active. The only commands accepted in this operating mode are **ATD** (dialing) and **AT-H**. Moreover, all echoes and feedback messages (such as OK, RING, CONNECT) will be suppressed. Polling is possible during call establishment.

*To restore the normal operation of the modem, enter the AT commands **AT-H0** and **AT&F** in two command lines.*



Display product information

ATI0 : Report product code in nnn format

ATI1 : Report checksum

ATI3 : Display firmware version and date

ATI4 : Display the current parameters of the Hayes command set

ATI6 : Display product name

ATI9 : Display plug and play information

ATI11 : Report self-test result

ATI0 displays a three digit ASCII string type number (modem product code).

ATI1 displays the least significant byte of a 16 bit checksum of the firmware ROM as a three digit ASCII number.

ATI3 displays the firmware version number and the firmware date. This command corresponds to the **AT%V** command.

ATI4 is used to output the current modem configuration (only Hayes commands).

ATI6 displays the product name of the modem.

ATI9 displays a string for plug and play recognition (e.g. for Windows 95).

ATI11 displays the result of the self-test the modem automatically performs after being switched on.

L Speaker volume

ATL0 : Low speaker volume

ATL1 : Low speaker volume

***ATL2 : Medium speaker volume**

ATL3 : High speaker volume

This command controls the volume of the modem speaker.

M Speaker control

ATM0 : Speaker always off

***ATM1 : Speaker on during call establishment**

ATM2 : Speaker always on

ATM3 : Speaker on while waiting for answer tone (outgoing call)

The speaker can be permanently on or off, or it can be switched on during the connection establishment phase (dialing and waiting for an answer tone **ATM1**), or it can be switched on only during the transition into the online state. This setting is used to influence also the signaling via S54 of a pending call by ringing.

-M

Plain text CONNECT messages

***AT-M0 : Plain text CONNECT messages dependent on ATV**

AT-M1 : Plain text CONNECT messages independent of ATV

This command influences the verbose CONNECT messages for error-corrected connections (connections with MNP, V.42, or V.42bis).

With the default setting **AT-M0**, the return of plain text CONNECT messages is dependent on the setting of the command **ATV**.

With **AT-M1** the following result codes are displayed upon successful connection, regardless of the setting of the **ATV** command and the transmission bit rate:

MNP1..4 connection: 'CONNECT MNP'

MNP5 connection: 'CONNECT MNP5'

V.42 connection: 'CONNECT LAPM'

V.42bis connection: 'CONNECT LAPM/V42BIS'

O

Return to online state with retrain**AT00** : Return to online state without retrain**AT01** : Return to online state with retrain

The command **AT00** can be used to switch back into the transfer mode to resume online data transmission if the modem is in the command mode after an escape command or a DTR transition from ON to OFF with a preceding **AT&D1**.

This command must be located in the last position of a command line (i.e. subsequent commands are not executed).

P

Set pulse dialing**ATP**

This command selects the pulse dialing (loop disconnect signaling) method.

\$P

Enter and save user password and callback number**AT\$P0;prefix****AT\$Pposition;mode;password;number**

The **AT\$P** command can be used to save up to 19 different user passwords in a list. The following parameters, separated by semicolons, can be used: The following entries are possible:

prefix

A separate dialing prefix for the callback numbers is saved in position 0 of the non-volatile memory. When using special dialing characters (see **ATD** command), make sure that they follow immediately after the semicolon (e.g. **at\$P0;t0w**).

position

This parameter, followed by at least one more parameter, defines the position (1..19) in the non-volatile memory, where the respective entry is to be

stored. If, for example, an entry is to be stored in the fourth position, the number 4 must be entered (e.g. **atSp4;1;kirk;1701**).

Existing entries can be modified by entering the respective parameter, thus overwriting the old setting. For example, if you want to change only the user password of an entry, enter only the position and the new password for the respective entry.

Example

To replace the password 'KIRK' in the entry **AT\$P4;1;KIRK;1701** by 'SPOCK' (**AT\$P4;1;SPOCK;1701**), enter the following:

atSp4;;spock

*If the **AT\$Pposition** command is used without additional parameters, the respective entry (0..19) is entirely deleted from the list (e.g. **at&p4** deletes the entry in position four).*



mode

This parameter can be used to set different security levels (see the following table). The individual values of the parameter <mode> are calculated by adding the decimal values of the respective bits and have the following meaning.

Bit	Dec.	Description
0	0	Entry locked
	1	Entry active
1..2	0	Only password required for identification
	2	Password and phone number required for identification
	4	Prompt for password, then callback of the stored phone number
	6	prompt for password and phone number, then callback of the entered number
3	0	Reserved
4..5	0	Remote configuration locked
	16	Remote configuration, display mode
	32	Remote configuration, modification mode
6..7	0	Reserved

password

This parameter is used to set the user password. The password must have at least four, but no more than eight characters.

number

This parameter can be used to save a phone number of up to 32 characters along with the user password in the list.

Q**Suppressing messages**

***ATQ0 : Enable modem result codes**

ATQ1 : Disable modem result codes

ATQ2 : Messages off in answer mode

With this command, messages to the attached computer by the modem can be completely suppressed (**ATQ1**) or suppressed in the answer mode only (**ATQ2**).

Q*Message after return to transfer phase**

***AT*Q0 : CONNECT message after invalid escape sequence**

AT*Q1 : No CONNECT message after invalid escape sequence

The return of the CONNECT message can be suppressed after an invalid escape sequence with this command.

%R**Display register contents**

AT%R

This command displays the current contents of the S registers (0..99) in two columns, decimally and hexadecimally.

\$R**Display user password and parameters**

AT\$R

The **AT\$R** command displays the stored user passwords, callback numbers and all other parameters on the screen.

Example

at\$r

00 – T0W

01 – 05;SPOCK;123456789

02 – 05;CLODWIG;333

03 –

04 – 01;KIRK;

05 –

06 – 33;EDUARD;333

07 – 35;SARAH;333

08 – 37;HANS;333

09 –

10–

11 –

12 –



If the **AT\$P** or **AT\$R** command is used and the 'P' access flag is inactive, the user is prompted to enter the supervisor password. If a wrong password is entered, the commands are not executed, but answered with **ERROR**.

S

Set and read the internal register

AT\$*n*=*x* : Set register *n* to value *x*

AT\$*n*? : Read the value of register *n*

AT\$*n* : Sets pointer to register *n*

AT? : Display the value of the last referenced register (default register)

AT=*x* : Set the default register to value *x*

The register number *n* and the register value *x* (0..255) are entered and displayed as numerical ASCII strings. The valid values for ***x*** may be restricted. Please refer to im Kapitel 'Description of registers' auf Seite 62 for information about the S register and changing bit-oriented registers (see Seite 44). If a register is set to an invalid value the command is ignored and returns

ERROR. If an invalid setting is made in a bit-oriented register, only that particular setting will be ignored; all other valid bits will be accepted.

&S

Importance of DSR

***AT&S0** : DSR always active

AT&S1 : DSR active between answer tone and disconnection

With this command, the importance of the DSR control circuit is affected. This interface line is usually always active. In case of **AT&S1** adjustment, DSR is only active in the time between when the answer tone stops and disconnection.

\S

Verbose display of the current configuration

AT\S : Display current configuration

The **AT\S** command displays the current configuration profile of the modem in verbose form.

\$S

Set access flags

AT\$\$

The **AT\$\$** command is used to set the access flags to define which modem functions can be used. After entering the command and the correct password, the current setting of the access flags (CONFIG) is displayed. After entering the new setting in the SET line, the new configuration (CONFIG) is displayed. Flags that have not been set are displayed as '- '.

Changes of the access flags always apply to the entire modem (not only to one of the configuration profiles) and are saved in the non-volatile memory.

Example

```
at$$
password ****
```

CONFIG: A-IO--P-

SET: AIO

CONFIG: A-IO---

OK

Access flags can only be changed by authorized users who enter the correct supervisor password. Any combination of the following access flags can be used:

Value	Description
A	All commands that do not change the non-volatile memory may be used ('All')
W	The commands ATSP , AT&W , AT*W , AT&Y and AT+ASTO may be used ('Write').
I	If 'I' has not been set, the modem is in the call protection mode. Calls cannot be answered with ATA , nor with ATS0 = 1 . The RING message is suppressed, only the RI interface line indicates an incoming call ('India!')
O	Outgoing calls are allowed ('Outdial')
P	The password list may be displayed and changed ('Password')



Locked commands are answered with ERROR.

\$S?

Query of current access flags

AT\$S?

The **AT\$S?** command can be used to check the current setting of the access flags. After entering the command, a list of the currently set flags is displayed on the screen.

Example

at\$S?

CONFIG:

AW-----

OK

T

Tone dialing method

ATT

This command selects the touch-tone dialing (multi-frequency dialing, DTMF signaling) method.

&T

Select digital loopback

AT&T0 : Normal operation

AT&T1 : Enable local digital loopback

AT&T3 : Enable remote digital loopback

***AT&T4 : Remote digital loopback accepted**

AT&T5 : Remote digital loopback blocked

AT&T6 : Enable remote digital loopback

This command sets several testing loopbacks and can be used as a function test. All digital loopbacks, with the exception of the local digital loopback, can be enabled only during an existing connection without error proofing (**AT+ES=1,0** or **AT+ES=,1**).

The testing modes can be terminated by changing to the command state and entering **AT&T0**.

AT&T1 enables the local digital loopback. Each character sent from the host to the modem is echoed. The **AT&T1** command can only be executed offline. The command is answered with **CONNECT**, and the DCD signal line is enabled.

The **AT&T3** command places the modem into a local digital loopback. The loopback is initiated by the remote modem. In this state, the characters sent by the remote modem are not transmitted to the host, but instead returned directly to the remote modem.

AT&T4 and **AT&T5** enable or disable, respectively, the activation of the digital loopback by the remote modem. The two commands can be used both

online and offline. The current status is displayed with the **ATI4** command (**AT&T** can only assume the values 4 and 5).

The **AT&T6** command enables a remote digital loopback (if the remote modem is set to **AT&T4**). In this mode, the remote modem does not pass the received characters to its host computer, but instead returns them directly to the local modem. The remote modem remains connected to the phone line (off-hook LED is on), the DCD and CTS signal lines are switched off. In this state, the remote modem cannot be addressed by the connected computer system.

\T

Inactivity timer

AT\Tn : (n = 0 to 255 * 10 seconds; default value = 0)

This command can be used to modify the time after which the modem automatically breaks the connection if no data has been sent or received in the mean time. The value of **AT\T** is a multiple of 10 seconds. Valid values for n are 0..255. The default value 0 is used to switch the inactivity time off.

\$T

Trace mode

***AT\$T0** : Trace mode OFF

AT\$T1 : Trace mode ON

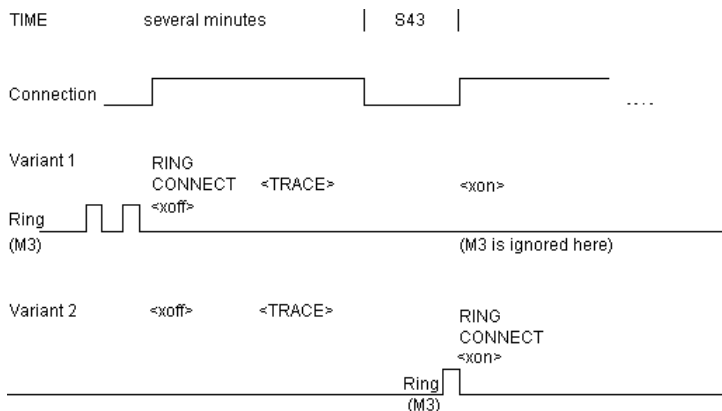
The **AT\$T** command enables or disables the trace mode. The trace mode can be used to monitor unsuccessful access attempts.

The **AT\$T0** command disables the trace mode, and feedback messages are not displayed.

The **AT\$T1** command enables the trace mode, and all feedback messages will be preceded by '+R'. Trace messages cannot be displayed in abbreviated form.

The current setting of the **AT\$B** and **AT\$T** commands can be displayed with the **ATI4** command.

The following illustration shows the methods 1 (**AT\$B1**) and 2 (**AT\$B2**) with enabled trace mode (**AT\$T1**):



If method 1 is used, the modem first displays the password and phone number of the remote modem after a RING. Then the messages +RNO CARRIER and +RCONNECT (at the time of <xon>) appear as trace text as well as the entries of the remote modem (user password and phone number).

If method 2 is used, the trace messages appear before the RING and CONNECT. After a +RRING and +RCONNECT, first the password and phone number of the remote modem are displayed. Then the messages +RNO CARRIER and +RCONNECT (at the time of <xoff>) appear as trace text as well as the entries of the remote modem (user password and phone number).

If the password protection or the automatic callback function is active, the following messages can be displayed at the remote modem:

password

The entered password is echoed on the screen.

PHONE NUMBER

The entered digits are echoed on the screen.

password OK

This message appears if password-protected access is active without the callback function.

CALLBACK IN n MIN

If the callback function is active, the value for n defined in the S43 register is displayed.

NO CARRIER

This message appears after the third identification attempt has failed.

*U

Take over current configuration

AT*U: Save current configuration

Changes made in the remote configuration mode remain active after leaving the remote configuration mode. The **AT*U** command can be used to take over the current configuration in the remote configuration mode. Otherwise the settings are only valid within the current remote configuration session.

To keep the changes after the modem is switched off, the configuration profile must also be saved in the non-volatile memory with the **AT&W** or **AT*W** command.

V

Messages in short form/plain text

ATV0 : Messages in short form as a digit

***ATV1** : Messages in plain text

This command allows you to choose whether the messages sent by the modem to the connected computer are displayed as digits or words. The messages in short form and plain text are covered in the chapter 'Description of messages'.

%V

Display of firmware version

AT%V

This command displays the modem firmware version on the monitor. This command corresponds to the **ATI3** command (see page 27).

&V

Display configuration profiles

AT&V

This command displays the current configuration and the two stored configuration profiles 0 and 1 (see also the **AT&W** and **AT*W** commands) of the modem on the monitor.

V

CONNECT with error free connections

ATV0 : No modified CONNECT messages

ATV1 : Identification of error-free connections

ATV2 : Identification of MNP and V.42bis connections

***ATV8** : Identification of MNP, V.42 and V.42bis connections

This command controls the CONNECT messages for error-corrected connections (connections with MNP, V.42 or V.42bis).

With **ATV0** modified CONNECT messages are always suppressed. The CONNECT messages for error-corrected connections are identical to the CONNECT messages for physical connections.

With **ATV1** the type of error-corrected connection is not differentiated (**xxxx** = transmission bit rate):

CONNECTxxxx/REL

With **ATV2** error-corrected connections are differentiated into MNP and V.42 (bis) connections:

CONNECTxxxx/REL - MNP with MNP connections

CONNECTxxxx/REL - LAPM with V.42(bis) connections

All of the settings listed have the disadvantage of not including complete information concerning the type of connection. The **ATV8** command allows a complete evaluation:

CONNECT xxxx/MNP with an MNP1..4 connection

CONNECT xxxx/MNP5 with an MNP5 connection

CONNECT xxxx/LAPM with a V.42 connection

CONNECT xxxx/LAPM/V42BIS with a V.42bis connection

Furthermore, the **ATV8** setting can be used to display 'Extended CONNECT messages' that provide additional information about the transmission standard used (e.g. **CONNECT xxxx/ V32BIS/ LAPM/ V42BIS**). For extended

CONNECT messages, bit 6 of register S96 (see page 81) must be set (**ATS96=64**). Possible values for the transmission mode string are:

B103, B212A, V21, V22BIS, V23, V32, V32BIS, V34, K56, V90

&W

Save configuration profile

AT&W0 : Store extended configuration profile 0

AT&W1 : Store extended configuration profile 1

This command can be used to save the current modem configuration in the non-volatile memory of the modem. Two different configuration profiles (0 and 1) can be stored.

The values are retained when the modem is switched off and are automatically recalled the next time the modem is turned on.



*Registers whose current value cannot be stored with the **AT&W** command are stored with their default value (**AT&F**). Therefore, the **AT&W** command overwrites those register values which are possibly stored with **AT*W**.*

*S registers can be stored with *W:*

S0, S2, S3, S4, S5, S6, S7, S8, S10, S11, S12, S14, S23, S25, S27, S28, S29, S30, S31, S34, S35, S42, S43, S47, S53, S64, S66, S93, S96, S99

S registers can be stored with &W:

S0, S14, S23, S25, S27, S28, S30, S31, S64, S93, S96, S99

*W

Save complete configuration profile

AT*W0 : Save extended configuration profile 0

AT*W1 : Save extended configuration profile 1

This command can be used to store the values of the following register in the non-volatile memory of the modem in addition to the parameters and registers stored with AT&W. The values are retained when the modem is switched off and are automatically recalled the next time the modem is turned on.

X

Handling of dial tone/busy tone

ATX0 : Ignore dial tone/ignore busy tone

ATX1 : Ignore dial tone/busy tone

ATX2 : Wait for dial tone/ignore busy tone

ATX3 : Ignore dial tone/evaluate busy tone

***ATX4** : Wait for dial tone/evaluate busy tone

This command is used to determine the dialing behavior. With **ATX2** or **ATX4**, respectively, the modem waits for the dial tone before dialing. With **ATX0**, **ATX1** or **ATX3**, the modem does not wait for the dial tone, thus allowing “blind dialing” for call establishment between two extensions.

Furthermore, you can use this command to determine whether your modem recognizes a busy tone and outputs the feedback BUSY or if it ignores the busy tone and aborts the dialing attempt with NO CARRIER.

*With the setting **ATX0**, only the message 'CONNECT' or '1' is output, independently of the speed and the kind of connection (with/without error correction-data compression).*



*X

End remote configuration

AT*X : End remote configuration

The **AT*X** command is used to end the remote configuration. A transition into the online phase takes place.

&Y

Set pointer to configuration profile

***AT&Y0** : Set pointer to configuration profile to 0

AT&Y1 : Set pointer to configuration profile to 1




You can use this command to determine which of the two stored configuration profiles (0 or 1) is loaded and used when the modem is turned on. This setting is globally and permanently effective and is stored at once.


\$Y

Change supervisor password

AT\$Y

The supervisor password can be changed with the **AT\$Y** command. An authorized modem user must identify himself by entering the supervisor password to access the modem functions. The factory default supervisor password is ELSA. This default password can be changed with the **AT\$Y** command.

The password must have at least four, but no more than eight characters. Valid characters are digits, upper case letters and special characters. Lower case letters are treated as upper case letters internally. Entered characters are always echoed with * and may be edited with  or . Every entered line must be terminated with .

When using **AT\$Y**, the new password must be entered twice and be terminated with . The repeated entry prevents a mistyped password from being stored as supervisor password.

If the two entries are identical, the new password is stored as supervisor password in the non-volatile memory and the **AT\$Y** command acknowledged with **OK**.

If the two entered passwords are not identical, the command is aborted with an **ERROR** message. Then the **AT\$Y** command must be used again in order to change the password.

Z

Load configuration profile

ATZ0 : Load configuration profile 0

ATZ1 : Load configuration profile 1

The **ATZ** command loads a configuration profile, independently of the setting done with the **AT&Y** command. If a connection exists it will be aborted. Then

the parameter settings (configuration profile 0 or 1) are loaded from the non-volatile memory of the modem.

This command must be located in the last position of a command line (i.e. subsequent commands are not executed). If you have not yet stored a configuration profile (**AT&W**, **AT*W**), the default configuration is loaded (**AT&F**).

Setting and reading of a bit in a register

AT.n=m : Sets the bit *n* to the value *m*
(*n* = 0 to 7; *m* = 0 to 1)

AT.n? : Reads the value of bit *n*

Register values can be changed using this command. The value for bit *n* defined in the corresponding register can be set to the value *m*. If access is not permitted, the value of the *S* register remains unchanged, and the modem answers with ERROR.

Example

To set the bit 6 of register *S14*, enter the command **ATS14.6=1**.

3.2 Extended command set

3.2.1 'AT+' command set

The **AT+** commands of the extended command set can be used to control selected modem functions in accordance with the V.250/V.253 standard.

The current parameter settings can be queried with **AT+<Command>?** (e.g. **AT+IFC?**). The valid range of parameter values is output through **AT+<Command>=?** (e.g. **AT+IFC=?**). Commands for which no range of values can be output are answered with ERROR.

+A8E Control of the V.8 and V.8bis negotiation

AT+A8E=<V8OriginatorKonf>,<V8AnswererKonf>,<V8CallFunction>,<V8bis>,<CallfunctionRange>,<ProtocolFunctionRange>

This command is used to control the V.8 and V.8bis negotiation. The following settings are valid:

Parameter	Value	Description
V8OriginatorKonf	0	V.8 negotiation as caller OFF
	1	Modem-controlled V.8 negotiation as caller ON
	6	Like 1 with additional output of a +A8X message to the computer
V8AnswererKonf	0	V.8 negotiation as remote station OFF
	1	Modem-controlled V.8 negotiation as caller ON
	5	Like 1 with additional output of a +A8X message to the computer
V8CallFunction	C1	Output of the hexadecimal value of the V.8 CI signals
V8bis	0	V.8bis negotiation OFF
	1	Modem-controlled V.8bis negotiation ON
CallfunktionRange		Refer to ITU-T-V.8 specifications
ProtokollFunktionRange		Refer to ITU-T-V.8 specifications

+ASTO Store speed-dial numbers

AT+ASTO=<position>,<dial_string>

This command is used to assign the speed-dial numbers 0-19 to a dial string. The parameter <position> designates the speed-dial number. The speed-dial numbers are executed by S=<position> (Special character for dialing stored phone numbers) in the dialing command. The ATDS command is used to dial the speed-dial numbers (page 21).

AT+ASTO? can be used to enter the assigned speed-dial numbers. A speed-dial number is deleted by entering the command for setting the speed-dial number, by entering only the position and an empty dial string (refer to the **ATD** command, page 21).

The following settings are valid:

Parameter	Value	Description
Position	0-19	Valid speed-dial numbers
Dial string	36	Maximum length of the dial string

Example

If you want to change only the third speed-dial number, enter the following command:

AT+AST0=3,""

+DR

Output of the data compression method

AT+DR=<parameter>

This command is used to control the output of the negotiated data compression method before the connect message. The following settings are valid:

Parameter	Value	Description
Parameter	0	Output OFF
	1	Output ON

The following are possible feedback messages by the modem before the output of the connect message:

+DR: NONE no data compression method selected
 +DR: V42B V.42bis selected
 +DR: ALT MNP5 selected

+DS

Data compression method

AT+DS=<direction>,<compression_negotiation>,<max_dict>,<max_string>

This command controls the data compression. The default setting is **AT+DS=3,0,2048, 32**, so the modem automatically recognizes which com-

pression method (depending on the capabilities or setting of the remote modem) to use.

direction

Select data compression.

**Compression_
negotiation**

The connection is not interrupted if no data compression method has been negotiated.

max_dict

States the maximum number of dictionary entries for V.bis data compression to be negotiated. This can be used by the computer to restrict the length of the code word sent, based upon the knowledge of the kind of the user data to be sent.

max_string

Maximum string length possible for V.42bis data compression.

The following settings are valid:

Parameter	Value	Description
direction	0	No data compression.
	3	Bidirectional V.42bis/MNP5 data compression
Compression_ negotiation	0	The connection is not interrupted if no data compression has been negotiated.
max_dict	2048	Maximum number of dictionary entries.
max_string	32	Maximum string length for V.42bis data compression.

+EFCS**FCS mode of operation in the V.42 mode****AT+EFCS=<parameter value>**

This command is used to control the application of the 16-bit frame check sequence (FCS) in the V.42 mode. The following settings are valid:

Parameter	Value	Description
Parameter value	0	16-bit FCS

+ER**Display of the error correction method****AT+ER=<parameter value>**

This command is used to switch the output of the negotiated error correction method on. The output takes place prior to the connect message. The following settings are valid:

Parameter	Value	Description
Parameter value	0	Disable modem result codes
	1	Enable modem result codes

The following messages can occur:

+ER: None No error correction method
 +ER: LAPM Error correction method according to LAPM selected
 +ER: ALT Error correction method according to MNP4 selected

+ES

Selection of the error correction method

AT+ES=<orig_rqst>,<orig_fbk>,<ans_fbk>

This command is used to select the error correction method the modem offers to the remote station during the negotiation of the data protocol.

orig_rqst

States the data protocol the calling modem (originate) attempts to negotiate at first. If the remote station does not support this protocol, the modem will fall back to the data protocols stated in <orig_fbk>.

orig_fbk

States possible data protocols offered by the modem of the remote side, if the data protocol cannot be negotiated in the <orig_rqst>.

ans_fbk

States the data protocols offered by the modem (answer) of the remote side.

The following settings are valid:

Parameter	Value	Description
orig_rqst	1	Connection only in the buffered mode.
	2	Negotiate error correction in accordance with V.42 without detect phase.
	3	Negotiate error correction in accordance with V.42 with detect phase.

Parameter	Value	Description
orig_fbk	4	Negotiate MNP.
	6	Negotiate V.80 synchronous-access mode (originate).
	0	LAPM or MNP are accepted as error correction methods. If no error correction can be negotiated, it is attempted to set up a connection in the buffered mode with data flow monitoring and computer-controlled speed.
	2	LAPM or MNP are accepted as error correction methods. If no error correction method can be negotiated, the modem hangs up.
	3	Only LAPM is accepted as error correction method. If no error LAPM can be negotiated, the modem hangs up.
ans_fbk	4	Only MNP is accepted as error correction method. If no MNP can be negotiated, the modem hangs up.
	1	Only buffered operation possible.
	2	LAPM or MNP are possible as error correction methods. If no error correction method is negotiated, a buffered connection is set up.
	4	LAPM or MNP are possible as error correction methods. If no error correction method is negotiated, the modem hangs up.
	5	Only LAPM is possible as error correction method. If no LAPM is negotiated, the modem hangs up.
	6	Only MNP is possible as error correction method. If no MNP is negotiated, the modem hangs up.
	8	V.80 synchronous-access mode exists (answer).

The following two tables provide an overview of the interaction of the parameters **orig_rqst** and **orig_fbk** of the **AT+ES** command.

Example

The modem is set to AT+ES=3,0 by default. In the upper table this configuration is described as case 6. Column 6 of the lower table shows the error correction methods possible for this setting (connection with V.42, MNP4 or without protocol).

The arrows pointing down in the lower table denote a fallback if the respective mode is not supported by the remote modem.

Tables for the representation of the error correction method:

orig_fbk	orig_rqst				
	1	2	3	4	6
0	4	5	6	7	0
2	4	1	8	—	0
3	4	1	2	—	0
4	4	—	—	3	0

	0	1	2	3	4	5	6	7	8
V.80	<input type="checkbox"/>	—	—	—	—	—	—	—	—
V.42 ^a	—	<input type="checkbox"/>	—	—	—	↓	—	—	—
V.42 ^b	—	—	<input type="checkbox"/>	—	—	—	↓	—	↓
MNP	—	—	—	<input type="checkbox"/>	—	—	↓	↓	<input type="checkbox"/>
Buffered	—	—	—	—	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	—

a. without detect phase

b. with detect phase

+ETBM

Buffer handling after connection abort

AT+ETBM=<sending buffer>,<receiving buffer>,<timer>

This command controls the data management in the modem buffer after the termination of a connection.

Sending buffer

Handling of the data in the sending buffer, if the local computer terminates the connection.

Receiving buffer

Handling of the data in the receiving buffer, if the remote station terminates the connection.

The following settings are valid:

Parameter	Value	Description
Sending buffer	0	Delete data in the sending buffer in case of connection abort
Receiving buffer	0	Delete data in the receiving buffer in case of connection abort

+GCI Country Selection

AT+GCI=<parameter value>

This command is used to select the country where you want to use the MicroLink 56k i. By default, the modem is configured for Germany. The following settings are valid:

Parameter	Value	Description
Parameter value	04	Germany
	0a	Austria
	A6	Switzerland

+GMI Display company name

AT+GMI

With this command, the company name is displayed.

+GMM Display product name

AT+GMM

With this command, the product name is displayed.

+GMR Display version number

AT+GMR

With this command, the version number is displayed.

+GSN

Display serial number

AT+GSN

With this command, the serial number is displayed.

+IFC

Flow control at the serial interface

AT+IFC=<DCE_by_DTE>,<DTE_by_DCE>

This command is used to set the flow control at the serial interface.

DCE_by_DTE

This parameter is used to control the method for the monitoring of the data flow **in the direction of the remote modem**, the method preset **by the computer**.

DTE_by_DCE

This parameter specifies the method preset **by the modem** for the control of the data flow **in the direction of the remote computer**. The following settings are valid:

Parameter	Value	Description
DCE_by_DTE	0	No flow control
	1	XON/XOFF flow control
	2	RTS flow control
	3	XON/XOFF flow control, XON/XOFF characters are passed on to the remote modem transparently
DTE_by_DCE	0	No flow control
	1	XON/XOFF flow control
	2	CTS flow control

+ILRR

Output of the data rate of the serial interface

AT+ILRR=<parameter value>

This command is used to switch the output of the bit rate of the computer on. The feedback message has the following format: '+ILRR: <bit rate of the computer>'. The following settings are valid:

Parameter	Value	Description
Parameter value	0	Output OFF
	1	Output ON

+IPR

Set bit rate of the computer

AT+IPR=<Bitrate>

With this command, the bit rate recognition is set. The bit rate of the computer is identified automatically. The following bit rates are supported: 300, 600, 1200, 2400, 4800, 7200, 9600, 19.200, 38.400, 57.600, 115.200, 230.400 bps.

Parameter	Value	Description
Bit rate	0	Automatic bit rate recognition

The **AT+IPR=?** command displays the automatically recognizable bit rates.

+MR

Output of the modulation method and of the line bit rate

AT+MR=<parameter value>

This command is used to control the output of the negotiated modulation method and of the line bit rate before the connect message. The receiving bit rate is output only if the sending and receiving bit rate are different.

The following settings are valid:

Parameter	Value	Description
Parameter value	0	Output OFF
	1	Output ON

The feedback messages have the following format:

+MCR: <carrier>

+MRR: <bit_rate>,<receiving_bit_rate>

+MS

Select modulation method

AT+MS=<carrier>,<automode>,<min_(tx_)rate>,<max_(tx_)rate>,<min_rx_rate>,<max_rx_rate>

This command is used to select the desired modulation method.

carrier

Modulation method used for calling attempts.

automode

If call establishment with the selected type of modulation fails, the modem uses another modulation type to set up a connection. The modulation type selection proceeds from higher to lower modulation types.

min_(tx_)rate

Optional numeric parameter that states the minimum data rate to be used by the modem to set up a connection.

min_rx_rate

If the value 0 (zero) is entered, the minimum bit rate is determined by the setting of the parameters <carrier> and <automode>. The lowest bit rate possible within the respective modulation type is selected.

A value higher than 0 (zero) states the minimum bit rate in bps used for calling attempts.

max_(tx_)rate

Optional numeric parameter that states the maximum data rate to be used by the modem to set up a connection.

max_rx_rate

If the value 0 (zero) is entered, the maximum bit rate is determined by the setting of the parameters <carrier> and <automode>. The highest bit rate possible in the respective modulation type is set, the maximum modulation type being additionally restricted by the bit rate set at the computer.

A value higher than 0 (zero) states the maximum bit rate in bps used for calling attempts.

min_rx_rate

These optional parameters can be used to set other data rates for the receiving direction than for the sending direction.

max_rx_rate

The following settings are valid:

Parameter	Value	Description
Carrier	B103	Bell 103 enabled
	B212A	Bell 212A enabled
	V21	V.21 enabled
	V22	V.22 enabled
	V23C	V.23 enabled
	V23S	V.23 half-duplex
	V32	V.32 enabled
	V32B	V.32bis enabled
	V34	V.34 enabled
	K56	56Kflex selected
	V90	V.90 enabled
Automode	0	Automode function OFF
	1	Automode function ON
min_(tx_)rate	0	Automatic bit rate selection
	75	Minimum send bit rate 75 bps
	300	Minimum send bit rate 300 bps
	600	Minimum send bit rate 600 bps
	1200	Minimum send bit rate 1200 bps
	2400	Minimum send bit rate 2400 bps
	4800	Minimum send bit rate 4800 bps
	7200	Minimum send bit rate 7200 bps
	9600	Minimum send bit rate 9600 bps
	12000	Minimum send bit rate 12,000 bps
	14400	Minimum send bit rate 14,400 bps
	16800	Minimum send bit rate 16,800 bps
	19200	Minimum send bit rate 19,200 bps
	21600	Minimum send bit rate 21,600 bps
	24000	Minimum send bit rate 24,000 bps
	26400	Minimum send bit rate 26,400 bps
	28000	Minimum send bit rate 28,000 bps
	28800	Minimum send bit rate 28,800 bps

Parameter	Value	Description
	29333	Minimum send bit rate 29,333 bps
	30667	Minimum send bit rate 30,667 bps
	31200	Minimum send bit rate 31,200 bps
	32000	Minimum send bit rate 32,000 bps
	33600	Minimum send bit rate 33,600 bps
max_(tx_)rate	see above	The range of values of the maximum send bit rate corresponds to the range of values of the minimum send bit rate
min_rx_rate	0	Automatic bit rate selection
	75	Minimum receive bit rate 75 bps
	300	Minimum receive bit rate 300 bps
	600	Minimum receive bit rate 600 bps
	1200	Minimum receive bit rate 1200 bps
	2400	Minimum receive bit rate 2400 bps
	4800	Minimum receive bit rate 4800 bps
	7200	Minimum receive bit rate 7200 bps
	9600	Minimum receive bit rate 9600 bps
	12000	Minimum receive bit rate 12,000 bps
	14400	Minimum receive bit rate 14,400 bps
	16800	Minimum receive bit rate 16,800 bps
	19200	Minimum receive bit rate 19,200 bps
	21600	Minimum receive bit rate 21,600 bps
	24000	Minimum receive bit rate 24,000 bps
	26400	Minimum receive bit rate 26,400 bps
	28000	Minimum receive bit rate 28,000 bps
	28800	Minimum receive bit rate 28,800 bps
	29333	Minimum receive bit rate 29,333 bps
	30667	Minimum receive bit rate 30,667 bps
	31200	Minimum receive bit rate 31,200 bps
	32000	Minimum receive bit rate 32,000 bps
	33333	Minimum receive bit rate 33,333 bps
	33600	Minimum receive bit rate 33,600 bps
	34000	Minimum receive bit rate 34,000 bps

Parameter	Value	Description
	34667	Minimum receive bit rate 34,667 bps
	36000	Minimum receive bit rate 36,000 bps
	37333	Minimum receive bit rate 37,333 bps
	38000	Minimum receive bit rate 38,800 bps
	38667	Minimum receive bit rate 38,667 bps
	40000	Minimum receive bit rate 40,000 bps
	41333	Minimum receive bit rate 41,333 bps
	42000	Minimum receive bit rate 42,200 bps
	42667	Minimum receive bit rate 42,667 bps
	44000	Minimum receive bit rate 44,000 bps
	45333	Minimum receive bit rate 45,333 bps
	46000	Minimum receive bit rate 46,000 bps
	46667	Minimum receive bit rate 46,667 bps
	48000	Minimum receive bit rate 48,000 bps
	49333	Minimum receive bit rate 49,333 bps
	50000	Minimum receive bit rate 50,000 bps
	50667	Minimum receive bit rate 50,667 bps
	52000	Minimum receive bit rate 52,000 bps
	53333	Minimum receive bit rate 53,333 bps
	54000	Minimum receive bit rate 54,000 bps
	54667	Minimum receive bit rate 54,667 bps
	56000	Minimum receive bit rate 56,000 bps
max_rx_rate	see above	The range of values of the maximum receive bit rate corresponds to the range of values of the minimum receive bit rate

Example

If you want your modem, in case of V.34 with a sending bit rate of 28,800 bps, to set up a connection with automatic speed selection disabled, enter the following command:

AT+MS=V34,0,28800,28800



With all modulation rates with the exception of V.90 and K56Flex, only the first two parameters (min_(tx_)rate, max_(tx_)rate) will be taken into

account. Please also refer to the following tables listing the bit defined after modulation types.

V.90	Receiving direction
	28000
	29333
	30667
	32000
	33333
	34667
	36000
	37333
	38667
	40000
	41333
	42667
	44000
	45333
	46667
	48000
	49333
	50667
	52000
	53333
	54667
	56000
V.90	Sending direction
	28000
	29333
	30667
	32000
K56flex	Receiving direction

	32000
	34000
	3600
	3800
	40000
	42000
	44000
	46000
	48000
	50000
	52000
	54000
	56000
K56flex	Sending direction
	32000
V.34	Sending and receiving direction
	2400
	4800
	7200
	9600
	12000
	14400
	16800
	19200
	21600
	24000
	26400
	28800
	31200
	33600
V.32bis	Sending and receiving direction
	4800

	7200
	9600
	12000
	14400
V.32	Sending and receiving direction
	4800
	9600
V.23C	Receiving direction/sending direction
	75/1200
	1200/75
V.23S	Sending and receiving direction
	1200 bps (half-duplex)
V.22bis	Sending and receiving direction
	1200
	2400
V.21	Sending and receiving direction
	300
BELL103	Sending and receiving direction
	300
Bell212A	Sending and receiving direction
	1200

\$JRING

Call signaling and RI line

AT\$JRING=,<Ring>,<RI_line>

This command can be used to control call signaling and the characteristics of the ring control line.

The following settings are valid:

Parameter	Value	Description
Ring	0	Ring signaling off
	1	Ring signaling on
RI line	0	Allow ring control line (RI/M3) of the modem
	1	Suppress the modem's ring control line (RI/M3)

Example

To disable ring signaling, make the following entry:

at\$ring=,0

4

Description of registers

The modem has internal registers with which you can control the configuration (see also command **ATSn**). Please refer to the following description for the significance of the registers.

S0

Automatic call answering

Valid parameters for Germany	0..9 rings
Valid parameters for Austria	0..5 rings
Valid parameters for Switzerland	0, 2..10 rings
Default value	0
Store in non-volatile memory	AT&W or AT*W

The automatic answering of calls can be set in the register S0. If S0 > 0, every incoming call will be automatically answered. The S0 value determines the number of ring pulses to wait before the call is answered.

If you enter an invalid value, the modem automatically uses the nearest allowed value (minimum or maximum) as the number of rings to be waited for. If, for example, in Germany the value 10 is entered, the modem automatically enters the value 9. If in Switzerland the value 1 is entered, the modem automatically enters the value 2.

With S0 being >0 the connection establishment can be aborted by any character (except for LF). Call establishment is not aborted, however, if bit 6 of register S14 has been set to 1 (default = 0). This setting permits the attached computer to send characters to the modem during call establishment.

S1

Ring Counter

Valid values	0..255 ring pulses
Default value	0
Store in non-volatile memory	no

Register S1 contains the number of rings of an incoming call. The S1 value is reset to zero, if after an interval defined in register S99 (see page 81) no more

pulses are received from the line (5 seconds by default). During this interval, no new calls can be identified and dialing is disabled.

S2 Escape code characters

Valid values	0 to 255 decimal
Default value	43 (+)
Store in non-volatile memory	AT*W

The escape command '+++' that is used to switch from the transfer phase to the command phase can be changed in register S2.

The transition to the command phase is blocked by values 0 and >128.



S3 Carriage return characters

Valid values	0 to 127 decimal
Default value	13 (carriage return)
Store in non-volatile memory	AT*W

The character for Return can be redefined in register S3.

S4 Line feed character

Valid values	0 to 127 decimal
Default value	10 (line feed)
Store in non-volatile memory	AT*W

The line feed character can be redefined in register S4.

S5

Backspace character

Valid values	0 to 32, 127 decimal
Default value	8 (backspace)
Store in non-volatile memory	AT*W

The backspace character can be redefined in register S5.

S6

Wait before blind dialing

Valid values	3..6 seconds
Default value	3 seconds
Store in non-volatile memory	AT*W

The time to elapse before the modem performs blind dialing (see also **ATX**, **ATX1** or **ATX3**, page 42) can be set in register S6.

S7

Wait for carrier

Valid parameters for Germany	10..100 seconds
Default value for Germany	90 seconds
Valid parameters for Austria	10..60 seconds
Default value for Austria	60 seconds
Valid parameters for Switzerland	10..100 seconds
Default value for Switzerland	90 seconds
Store in non-volatile memory	AT*W

The amount of time that the modem waits for the carrier after dialing is set in register S7.

S8 Pause length of ','

Valid values	0..8 seconds
Default value	2 seconds
Store in non-volatile memory	AT*W

The length of a dialing pause ',' is determined in register S8.

S10 Delay for hang up after carrier loss

Valid values	1..255 1/10 seconds
Default value	10 (0.3 seconds)
Store in non-volatile memory	AT*W

Register S10 determines the period of time after which the modem terminates the connection if no carrier signal is detected. This setting is relevant only for the transmission methods V.21, V.22bis and V.23.

S11 Dialing speed for tone dialing

Valid parameters for Germany	85 to 95 (1/1000 sec.)
Default value for Germany	90 (90 ms)
Valid parameters for Austria	75 to 145 (1/1000 sec.)
Default value for Austria	80 (80 ms)
Valid parameters for Switzerland	70 to 105 (1/1000 sec.)
Default value for Switzerland	80 (80 ms)
Store in non-volatile memory	AT*W

The speed of the tone dialing process (i.e. the duration of each dialing tone) can be changed in register S11.

S12 Escape prompt delay

If no further characters follow the three escape sequences (+++) within one second, the modem will respond in advance with OK and will continue to wait for a valid command line.

Valid values	0 to 255 (1/50 sec.)
Default value	50 (1 sec.)
Store in non-volatile memory	AT*W

The length of the escape prompt delay is established in register S12.

S14 Bit-oriented option

The contents of register S14 is stored in the non-volatile memory with the commands **AT&W** or **AT*W**. The individual bits have the following significance:

Bit	Dec.	Description
0..5	0	0 Reserved
6	0	0 Polling not possible during call establishment ^a
	64	1 Polling possible during call establishment ^b
7	0	0 Modem in the answer mode
	128	1 Modem in the originate mode

- Polling not possible during call establishment (the call establishment is aborted by any character other than LF, XON and XOFF).
- Polling is always possible in the dumb mode.

S16

Bit-mapped options

This register is read-only. It contains information about the status of an active loopback:

Bit	Dec.	Description	
0	0	0	Local analog loop disabled
	1	1	Local analog loop enabled
1	0	0	Reserved
2	0	0	Local digital loop disabled
	4	1	Local digital loop enabled
3	0	0	No initiated remote digital loop
	8	1	Initiated remote digital loop
4	0	0	Remote digital loop disabled
	16	1	Remote digital loop enabled
5..7	0	0	Reserved

S23

Bit-oriented option

The contents of register S23 is stored in the non-volatile memory with the commands **AT&W** or **AT*W**. The individual bits have the following significance:

Bit	Dec.	Description	
0..3	0	0	Reserved
4..5	0	0	7E1
	16	1	8N1
	32	2	701
	48	3	7N2
6..7	0	0	Reserved



The value of bit 1 to 3 of register S23 is overwritten after every AT.

S25

DTR Delay

Valid values	0..255(1/100 seconds)
Default value	5 (0.05 seconds)
Store in non-volatile memory	AT&W or AT*W

Register S25 can be used to set the minimum duration of a DTR change to have any effect. This affects those features that are set with the **AT&Dn** and **AT\$Dn** commands.

S27

Bit-mapped options

The contents of register S27 can be stored in the non-volatile memory using the **AT&W** or **AT*W** command. The individual bits have the following significance:

Bit	Dec.	Description
0..6	0	0 Reserved
7	0	0 Duplex
	128	1 Half-duplex

S28

Bit-mapped options

The contents of register S28 can be stored in the non-volatile memory using the **AT&W** or **AT*W** command. The individual bits have the following significance:

Bit	Dec.	Description
0..4	0	0 Reserved
5	0	0 Bit rate tolerance: -2,5% + 1,0%
	32	1 Bit rate tolerance: -2.5% + 2.3%
6	0	0 Reserved
7	0	0 Ring message and call acceptance not possible if DTR = OFF
	128	1 Ring message and call acceptance possible if DTR = OFF

S29

Bit-mapped options

The contents of register S29 can be stored in the non-volatile memory using the **AT*W** command. The individual bits have the following significance:

Bit	Dec.	Description
0	0	0 Automatic fallback to V.23 allowed
	1	1 =Automatic fallback to V.23 not allowed
1	0	0 Asymmetric bit rates OFF
	2	1 Asymmetric bit rates ON
2..3	9	0 Reserved
4	0	0 Rate renegotiation with V34, V.90, K56flex, V.34 and V.32bis ON
	16	1 Rate renegotiation with V34, V.90, K56flex, V.34 and V.32bis OFF
5	0	0 Disable V.32 clear down sequence
	32	1 Enable V.32 clear down sequence
6	0	0 V.32: 9600 bps uncoded
	64	1 V.32: 9600 bps Trellis coded

S30

Inactivity timer

Valid parameters	0 to 255 (10 sec.)
Default value	0 (timer off)
Store in non-volatile memory	AT&W or AT*W

Register S30 can be used to set the time after which the modem automatically breaks the connection if no data has been sent or received in the mean time. A value of zero disables the inactivity timer.

S31

Bit-oriented option

The contents of register S31 is stored in the non-volatile memory with the commands **AT&W** or **AT*W**. The individual bits have the following significance:

Bit	Dec.	Description
0..2	0	0 Reserved
3	0	0 Calling tone according to ITU-T V.25
	8	1 Calling tone according to ITU-T V.8
4..6	0	0 Reserved
7	0	0 Dial lock of two hours after the 12th unsuccessful dialing attempt^a
	128	1 Dialing pause of 30 seconds after every unsuccessful dialing attempt

- a. Bit 7 of register S31 is valid for Germany only. In Austria and Switzerland, bit 7. is reserved.

S34

Configuration command

Valid values	0 to 127 decimal
Default value	42 (*)
Store in non-volatile memory	AT*W

Register S34 can be used to change the configuration command ********, which is used to change from the online state to the remote configuration state.

S35

Number of callback attempts

Valid values	1..99
Default value	3
Store in non-volatile memory	AT*W

In Register S35, the number of times your modem attempts to call back can be defined.

S42

Wait for user password

Valid values	20..120 seconds
Default value	30 seconds
Store in non-volatile memory	AT*W

The amount of time that the modem waits for the password entry after successful call establishment is set in register S7.

S43

Callback delay

Valid values	1..12 minutes
Default value	1 minute
Store in non-volatile memory	AT*W

The value for the call delay of the modem is defined in register S43.

S47

Fallback character

Valid values	0..62, 64..125, 127 (decimal)
Default value	0
Store in non-volatile memory	AT&W or AT*W

In register S47, the ASCII character ($n = 1..127$) that is evaluated as fallback character when the call is accepted (see also command **AT%A**, page 17) can be defined. For this purpose, the command **ATC2** (see page 19) must be set. The default setting 0 disables the fallback character recognition entirely.

S53

Bit-oriented option

The contents of register S53 is stored in the non-volatile memory with the commands **AT&W** or **AT*W**. The setting of the bits 0 to 1 is only effective for the file format between the modem and the computer. The setting is only effective in the transfer phase. The telephone-side data format is always

8N1, regardless of this setting. In the default setting, the data format from register S23 is used. The individual bits have the following significance:

Bit	Dec.	Description
0..1	0	0 10-bit data format in the transfer phase (8N1, 7E1, 7O1 or 7N2)
	1	1 11-bit data format in the transfer phase: 8E1
	2	2 11-bit data format in the transfer phase: 8O1
	3	3 11-bit data format in the transfer phase: 8N2
2..7	0	0 Reserved

S54 Bit-oriented option

This register is independent of the command **AT&F** but dependent of the command **ATMn**. The settings for this register can be stored to non-volatile memory with the command **AT*W**.

Bit	Dec.	Description
1	0	0 The serial speed is loaded from profile by new initialization
	2	1 The serial speed is not changed in case of new initialization
2	0	0 XOFF (software handshake) remains unchanged in case of new initialization
	4	1 XOFF (software handshake) is reset in case of new initialization

S64 Setting of the sent signal level in dial-line operation

Valid values	10..15 (-x.5 dBm)
Default value	10 (-10.5 dBm)
Store in non-volatile memory	AT*W

In register S64, the telephone line transmission signal level of the modem can be changed. A value of 10 corresponds to a transmission level of -10.5 dBm.

S65

Output of the received signal level

In register S65, the received signal level can be output (in -dBm). Register S65 can be read only.

S66

Bit-mapped options

In register S66, the symbol rate offered in V.34 operation is defined. With this option, certain symbol rates can be suppressed. The settings for this register can be stored to non-volatile memory with the command **AT*W**. The individual bits have the following significance:

Bit	Dec.	Description
0	0	Symbol rate 2400 bps OFF
	1	Symbol rate 2400 bps ON (max. 21,600 bps)
1	0	Reserved
2	0	Symbol rate 2800 bps OFF
	4	Symbol rate 2800 bps ON (max. 24,000 bps)
3	0	Symbol rate 3000 bps OFF
	8	Symbol rate 3000 bps ON (max. 26,400 bps)
4	0	Symbol rate 3200 bps OFF
	16	Symbol rate 3200 bps ON (max. 31,200 bps)
5	0	Symbol rate 3429 bps OFF
	32	Symbol rate 3429 bps ON (max. 33,600 bps)
6..7	0	Reserved

S84

Bit-mapped options

Register S84 stores the symbol rate established during a V.90, K56flex or V.34 connection. This register is read-only. The individual bits have the following significance:

Bit	Dec.	Description
0..2	0	0 2400 bps
	1	1 Reserved
	2	2 2800 bps
	3	3 3000 bps
	4	4 3200 bps
	5	5 3429 bps

S86

Call failure reason code

Register S86 can be read only. The value of S86 indicates the reason for the last connection failure:

Dec.	Description
0	Normal disconnection, no error occurred
4	Loss of carrier
5	Negotiation phase failed; modem at remote station has no error correction
6	Remote modem is not answering protocol requests
7	Remote modem is only functioning synchronously
8	Modems could not find a common framing
9	Modems could not find a common protocol
10	Remote modem is sending wrong protocol requests
11	Synchronous information (data or flags) missing; connection termination after 30 seconds
12	Normal disconnect, initiated by the remote modem
13	Remote modem is no longer answering; disconnect after 10 re-transmissions
14	Protocol violation

Dec.	Description
15	Compression error
16	Inactivity time has elapsed
17	No loop current
20	Busy tone detected
21	No dial tone detected
22	No answer tone detected (time-out S7)
23	No connection reached (time-out) or wrong modulation type
24	No common type of modulation
25	No modem is answering at the number called
26	Invalid login attempt or invalid password
27	Automatic dialing
30	ATH (online)
31	ATZ (online)
32	AT&T0 (in analog loopback)
33	Termination via keystroke
32	Termination via DTR
41	Termination by level change
42	Termination by synchronization loss
43	Termination by clear down sequence
68	No answer to automatic retrain

S87Bit-mapped options

Register S87 can be read only. It contains information about the current connection:

Bit	Dec.	Description
0..4	1	1 Minimum send bit rate 75 bps
	2	2 Minimum send bit rate 1200 bps
	3	3 Minimum send bit rate 300 bps
	4	4 Reserved
	5	5 Minimum send bit rate 1200 bps
	6	6 Minimum send bit rate 2400 bps

Bit	Dec.	Description	
	7	7	Minimum send bit rate 4800 bps
	8	8	Minimum send bit rate 7200 bps
	9	9	Minimum send bit rate 9600 bps
	10	10	Minimum send bit rate 12,000 bps
	11	11	Minimum send bit rate 14,400 bps
	12	12	Minimum send bit rate 16,800 bps
	13	13	Minimum send bit rate 19,200 bps
	14	14	Minimum send bit rate 21,600 bps
	15	15	Minimum send bit rate 24,000 bps
	16	16	Minimum send bit rate 26,400 bps
	17	17	Minimum send bit rate 28,000 bps
	18	18	Minimum send bit rate 28,800 bps
	19	19	Minimum send bit rate 29,333 bps
	20	20	Minimum send bit rate 30,667 bps
	21	21	Minimum send bit rate 31,200 bps
	22	22	Minimum send bit rate 32,000 bps
	23	23	Minimum send bit rate 33,600 bps
5..7	0	0	Reserved

S88 Bit-mapped options

Register S88 can be read only. It contains information about the current connection:

Bit	Dec.	Description	
0	0	0	No connection with MNP1..4
	1	1	Connection with MNP1..4
1	0	0	No connection with MNP5
	2	1	Connection with MNP5
2	0	0	No connection with V.42
	4	1	Connection with V.42

Bit	Dec.	Description	
3	0	0	No connection with V.42bis
	8	1	Connection with V.42bis
4..7	0	0	Reserved

S89

Bit-mapped options

Register S89 can be read only. It contains information about the current connection:

Bit	Dec.	Description	
0..4	1	1	DCE line receive bit rate 75 bps (V.23)
	2	2	DCE line receive bit rate 1200 bps (V.23)
	3	3	DCE line receive bit rate 300 bps
	4	4	DCE line receive bit rate 600 bps
	5	5	DCE line send bit rate 1200 bps
	6	6	DCE line receive bit rate 2400 bps
	7	7	DCE line receive bit rate 4800 bps
	8	8	DCE line receive bit rate 7200 bps
	9	9	DCE line receive bit rate 9600 bps
	10	10	DCE line receive bit rate 12,000 bps
	11	11	DCE line receive bit rate 14,400 bps
	12	12	DCE line receive bit rate 16,800 bps
	13	13	DCE line receive bit rate 19,200 bps
	14	14	DCE line receive bit rate 21,600 bps
	15	15	DCE line receive bit rate 24,000 bps
	16	16	DCE line receive bit rate 26,400 bps
	17	17	DCE line receive bit rate 28,800 bps
	18	18	DCE line receive bit rate 31,200 bps (only V.34)
	19	19	DCE line receive bit rate 33,600 bps (only V.34)
	20	20	DCE line receive bit rate 28,800 bps (only V.90)
	21	21	DCE line receive bit rate 29,333 bps (only V.90)
	22	22	DCE line receive bit rate 30,667 bps (only V.90)
	23	23	DCE line receive bit rate 32,000 bps (K56FLEX and V.90)

Bit	Dec.	Description
	24	DCE line receive bit rate 33,333 bps (only V.90)
	25	DCE line receive bit rate 34,000 bps (only K56FLEX)
	26	DCE line receive bit rate 34,667 bps (only V.90)
	27	DCE line receive bit rate 36,000 bps (K56FLEX and V.90)
	28	DCE line receive bit rate 37,333 bps (only V.90)
	29	DCE line receive bit rate 38,000 bps (only K56FLEX)
	30	DCE line receive bit rate 38,667 bps (only V.90)
	31	DCE line receive bit rate 40,000 bps (K56FLEX and V.90)
	32	DCE line receive bit rate 41,333 bps (only V.90)
	33	DCE line receive bit rate 42,000 bps (only K56FLEX)
	34	DCE line receive bit rate 42,667 bps (only V.90)
	35	DCE line receive bit rate 44,000 bps (K56FLEX and V.90)
	36	DCE line receive bit rate 45,333 bps (only V.90)
	37	DCE line receive bit rate 46,000 bps (only K56FLEX)
	38	DCE line receive bit rate 46,667 bps (only V.90)
	39	DCE line receive bit rate 48,000 bps (K56FLEX and V.90)
	40	DCE line receive bit rate 49,333 bps (only V.90)
	41	DCE line receive bit rate 50,000 bps (only K56FLEX)
	42	DCE line receive bit rate 50,667 bps (only V.90)
	43	DCE line receive bit rate 52,000 bps (K56FLEX and V.90)
	44	DCE line receive bit rate 53,333 bps (only V.90)
	45	DCE line receive bit rate 54,000 bps (only K56FLEX)
	46	DCE line receive bit rate 54,667 bps (only V.90)
	47	DCE line receive bit rate 56,000 bps (K56FLEX and V.90)

S90

Current type of modulation

Register S90 can be read only. It contains information about the current type of modulation:

Bit	Dec.	Description
0..3	0	0 BELL103
	1	1 Bell 212A
	2	2 V.23
	3	3 V.21
	4	4 V.22
	5	5 V.22bis
	6	6 V.32
	7	7 V.32bis
	8	8 Reserved
	9	9 V.34
	10	10 K56FLEX
	11	11 V.90
4	0	0 Reserved
5	32	0 Full-duplex Operation
		1 Half-duplex Operation
6	64	0 Modem Operation"
7	128	0 Symmetrical connection (receive bit rate = send bit rate)
		1 Asymmetrical connection (receive bit rate = send bit rate)

S93

Bit-oriented option

The contents of register S93 is stored in the non-volatile memory with the commands **AT&W** or **AT*W**. The individual bits (0 to 16 decimal) have the following significance:

Bit	Dec.	Description
0..4	0	0 Computer-side bit rate 300 bps
	1	1 Computer-side bit rate 300 bps
	2	2 Computer-side bit rate 300 bps
	3	3 Computer-side bit rate 300 bps
	4	4 Computer-side bit rate 600 bps
	5	5 Computer-side bit rate 1200 bps
	6	6 Computer-side bit rate 2400 bps
	7	7 Computer-side bit rate 4800 bps
	8	8 Computer-side bit rate 7200 bps
	9	9 Computer-side bit rate 9600 bps
	10	10 Computer-side bit rate 12,000 bps
	11	11 Computer-side bit rate 14,400 bps
	12	12 Computer-side bit rate 19,200 bps
	13	13 Computer-side bit rate 38,400 bps
	14	14 Computer-side bit rate 57,600 bps
	15	0 Reserved
	16	16 Computer-side bit rate 115,200 bps
5..7	0	0 Reserved



*The S93 value is overwritten after every **AT***

S96

Bit-oriented option

The contents of register S96 is stored in the non-volatile memory with the command **AT*W**. The individual bits have the following significance:

Bit	Dec.	Description
0..1	0	0 Decimal display of S registers
	1	1 Hexadecimal display of S registers
	2	2 Binary display of S registers
2	0	0 Message 'Continue with any character...' yes
	4	1 Message 'Continue with any character...' no
3	0	0 Display of messages in plain text (German)
	8	1 Display of messages in plain text (English)
4	0	0 Reserved
5	0	0 The receive bit rate is output in the CONNECT message
	32	1 The send and receive bit rates are output in the CONNECT message
6	0	0 No output of the modulation method with extended CONNECT message
	64	1 Output of the modulation method with extended CONNECT message
7	0	0 Reserved

S99

Time difference between ring pulses

Valid values	10..255 (1/10 seconds)
Default value for Germany	75 (5 seconds)
Default value for Austria	60 (6 seconds)
Default value for Switzerland	50 (5 seconds)
Store in non-volatile memory	AT&W or AT*W

The maximum allowed delay between received ring tones is set in register S99. Usually the standard value of 7.5 seconds need not be changed. If, however, ring pulses are sent at longer intervals in a telecommunications service network, increasing the maximum delay in register S99 prevents the ring counter (see register S1) from being reset to zero after each ring.

5 Description of messages

5.1 Commands with effect on messages

Insofar as the command **ATQ1** is not active (messages off), the modem will acknowledge input commands and provide messages regarding incoming calls or the establishment of a connection, for example.

With the default setting **ATV1**, the modem returns messages in plain text (followed by `(Enter)` and a line feed character). With the command **ATV0**, the messages are returned in short form as a digit (with a leading or concluding `(Enter)`).

V1	V0	Description
OK	0	Command line executed
RING	2	Incoming call
NO CARRIER	3	No connection established or inactivity timer expired
ERROR	4	Error during command input
NO DIALTONE	6	No dial tone detected
BUSY	7	Called station busy
DIAL LOCKED	8	Dial function locked
NO ANSWER	10	After special dialing character @ no silence identified
DELAYED		Dialing delay with alternative dial lock

CONNECT Messages

The CONNECT messages, i.e. the messages regarding a successful connection, are controlled by the **AT-M**, **ATV** and **ATX** commands. The following table provides an overview of possible CONNECT messages.

Short form	Plain text
1	CONNECT 300
5	CONNECT 1200
10	CONNECT 2400
11	CONNECT 4800

Short form	Plain text
12	CONNECT 7200
13	CONNECT 9600
14	CONNECT 12000
16	CONNECT 14400
21	CONNECT 300/REL
22	CONNECT 1200/REL
23	CONNECT 2400/REL
24	CONNECT 4800/REL
25	CONNECT 7200/REL
26	CONNECT 9600/REL
27	CONNECT12000/REL
28	CONNECT 14400/REL
51	CONNECT 1200/HX
52	CONNECT 75/1200
53	CONNECT 1200/75
110	CONNECT 16800
111	CONNECT 19200
112	CONNECT 21600
113	CONNECT 24000
114	CONNECT 26400
115	CONNECT 28800
116	CONNECT 31200
117	CONNECT 33600
120	CONNECT 16800/REL
121	CONNECT 19200/REL
122	CONNECT 21600/REL
123	CONNECT 24000/REL
124	CONNECT 26400/REL
125	CONNECT 28800/REL
126	CONNECT 31200/REL
127	CONNECT 33600/REL
150	CONNECT 32000
151	CONNECT 34000

Short form	Plain text
152	CONNECT 36000
153	CONNECT 38000
154	CONNECT 40000
155	CONNECT 42000
156	CONNECT 44000
157	CONNECT 46000
158	CONNECT 48000
159	CONNECT 50000
160	CONNECT 52000
161	CONNECT 54000
162	CONNECT 56000
170	CONNECT 32000/REL
171	CONNECT 34000/REL
172	CONNECT 36000/REL
173	CONNECT 38000/REL
174	CONNECT 40000/REL
175	CONNECT 42000/REL
176	CONNECT 44000/REL
177	CONNECT 46000/REL
178	CONNECT 48000/REL
179	CONNECT 5000/REL
180	CONNECT 52000/REL
181	CONNECT 54000/REL
182	CONNECT 56000/REL

V.24 interface

The interface between the modem and the computer consists of a variety of data, control and signaling lines. The condition of most of the interface lines is displayed by LEDs on the front of the unit.

The pin assignment of the V.24 interface for 9-pin or 25-pin connectors is as follows:

9-pin	25-pin	DIN	ITU-T	USA	Designation (USA)	Designation direction (D)
U ^a	1	E1	101	GND	Protective Ground	Protective Ground—
5	7	E2	102	GND	Signal Ground	Operating Ground—
3	2	D1	103	TxD	Transmit Data	Send data→ modem
2	3	D2	104	RxD	Receive Data	Receive data← modem
6	6	M1	107	DSR	Data Set Ready	Modem ready← modem
8	5	M2	106	CTS	Clear to Send	Ready to send← modem
9	22	M3	125	RI	Ring Indicator	Incoming call← modem
1	8	M5	109	DCD	Data Carrier Detect	Receive signal level← modem
47	36	S1	108	DTR	Data terminal ready	DEE ready→ modem
	4	S2	105	RTS	Request to send	Switch sending on → modem

a. Housing/shield



The designations in the table name the functions of the lines (e.g. transmission data) as related to the data terminal (computer).

The interface lines have the following significance:

- **Computer/terminal operational – DTR = Data terminal ready**

- The effect of this control line on the modem is determined by the command **AT&D**.

- **Switch on transmission – RTS = Request to send**

- **Operational – DSR = Data set ready**

- This signal line is normally always active (ON), but is controlled by the commands **AT&D** and **AT&S**.

- **Clear to send – CTS = Clear to send**

- This output is normally always active (ON), but is controlled by the commands **AT&D**, **AT&FC** and **AT&R**.

- **Incoming call – RI = Ring indicator**

- This modem output becomes active (ON), as soon as the modem recognizes an incoming call (also refer to the **ATA command**). Incoming calls are detected only if the DTR control line is active (ON) or the command **AT&D0** has been issued.

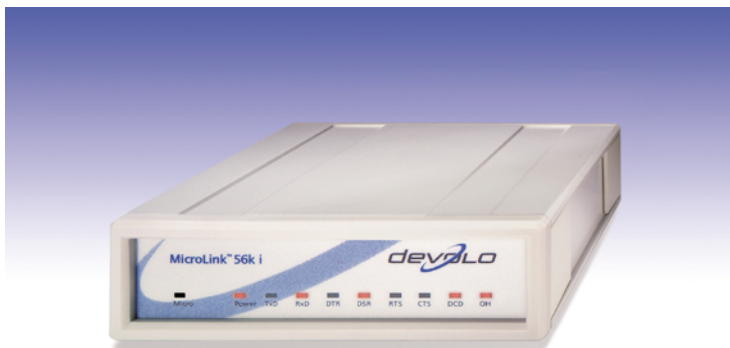
- **Connection – DCD = Data carrier detect**

- This modem output normally becomes active (ON) when the modem has established a valid connection.

6 Appendix

6.1 Status display and troubleshooting

The LEDs on the front panel show the condition of the interface lines or the condition of the modem. Behind 'Micro' is the internal microphone..



- | | |
|---|--|
| ❶ | Microphone |
| ❷ | Modem turned on |
| ❸ | Data to modem |
| ❹ | Data from modem |
| ❺ | Computer operational |
| ❻ | Modem operational |
| ❼ | Hardware-handshake-control line to the modem |
| ❽ | Hardware-handshake-control line to the modem |
| ❾ | Connection established |
| ❿ | Modem online (off hook) |

6.2

Technical data

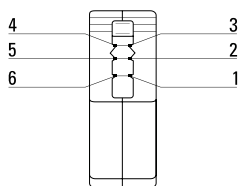
Users with specific technical interests should refer to this chapter for detailed information on MicroLink 56k i. All connections and their pin assignments are described in detail..

	MicroLink 56k i
Data transfer standard and protocols	V.17, V.21, V.21channel2, V.22, V.22bis, V.23, V.27, V.29, V.32, V.32bis, V.33, V.34, V.80, V.90, K56flex, Bell 103, Bell 212A full duplex
Power supply	9 – 30 V _{AC} , 9 – 42 V _{DC} * Power adapter 230V/9 V AC, 800 mA, TÜV GS approved
Dimensions and design	108 x 38 x 140 mm (W x H x D), robust metal case
Ambient conditions	0..50°C 0..80%, non-condensing
Transfer rates	Receive: 300 – 56.000 bps Send: 300 – 33.600 bps
Transmission procedures	Asynchronous or synchronous
Error correction	V.42 and MNP Class 4
Data compression	V.42bis and MNP Class 5
Command set	AT command set in accordance with V.250/V.253
Fax operation	14.400..2400 bps in accordance with V.17, V.33, V.29 and V.27ter; fax command set, Class 1 (TIA/EIA-578), TR-29.2 Class 2 (SP-2388) and TR-29.2 Class 2.0 ITU-T and T.32, Class 1.0 ITU-T and T.31
Voice operation	Voice command set in compliance with TIA/EIA IS 101 and Rockwell
Dialing method	Pulse and tone dialing
External call	Via flash function or digit
BPS ADJUST	Automatic in accordance with V.8, V.8bis and V.100 (can be disabled)
Access control	Security callback (automatic callback function) Remote configuration with password protection
Operating surveillance	9 LEDs: Power, TxD (transmit data), RxD (receive data), DTR (data terminal ready), DSR (data set ready), RTS (request to send), CTS (clear to send) DCD (data carrier detect), OH (off hook)

	MicroLink 56k i
Computer interface	V.24/V.28, 9-pin, sub-D Automatic bit rate and data format recognition Bit rate: 300 – 230.400 bps asynchronous Data format: 10/11-bit, parity: even/odd/none (7,e,1 7,o,1 8,n,1 8,e,1) Handshake: RTS-CTS, XON-XOFF
Line adapter	Country-specific
Line type	Tip/ring line
Electrical isolation	2 KV according TBR 21
Signal levels	According to TBR 21
Power consumption	2.75 W (typ.) Sleep mode: 1.75 W
Security	Supervisory circuit: Integrated watchdog Electrical supervision via power fail
Miscellaneous	Power up call DTR dial 20 quick dialing memory Flash technology (firmware update) Integrated meter puls filter Integrated microphone Integrated loudspeaker On-off switch
Operating systems	Windows 98, Windows NT 4.0, Windows Me, Windows 2000, Windows XP
CE conformity	CE-compliant in accordance with R&TTE technical requirements for all EU countries and Switzerland Tested in accordance with EN 55024, EN 55022, Class B, EN 60950, TBR 21, EG 201 121

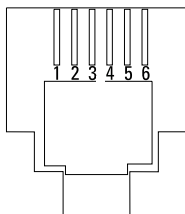
*The device can be supplied with direct current (DC). If power is put into the socket a potential difference of 0.7V between the DC source ground and the interface ground occurs (due to the rectifier diode). If these grounds are shorted galvanically the electric current flows back via the interface ground—following the lowest resistance. Normally, this does not cause problems.

Line port TAE6-N adapter Germany



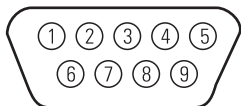
Line	TAE6 contact	Explanation
A	1	Telephone line
b	2	Telephone line
a ₂	6	Return line
b ₂	5	Return line
—	3	Not occupied
—	4	Not occupied

Line port (RJ11 line adapter)



Line	Telephone socket	Explanation
—	1	Not occupied
b ₂	2	Return line
b	3	Telephone line (tip)
a	4	Telephone line (ring)
a ₂	5	Return line
—	6	Not occupied

Line port 9-pin d-sub



DIN	9-pin d-sub	Explanation (USA)
E1	U	GND
E2	5	GND
D1	3	TxD
D2	2	RxD
M1	6	DSR
M2	8	CTS
M3	9	RI
M5	1	DCD
S1.1	4	—
S1.2	4	DTR
S2	7	RTS

6.3

Declaration of conformity



KONFORMITÄTSERKLÄRUNG

gemäß dem Gesetz über Funkanlagen und Telekommunikationsendeinrichtungen (FTEG) und der Richtlinie 1999/5/EG (R&TTE)

EC- DECLARATION OF CONFORMITY appropriate to the law of radio and telecom terminalequipment and Directive 1999/5/EC (R&TTE)

Die Firma: **devolo AG**
The Company: **Sonnenweg 11**
52070 Aachen

erklärt, daß das Produkt: **MicroLink™ 56k i**
declares that the product:

Telekommunikations (TK-) Endeinrichtung
telecommunications terminal equipment radio equipment

Verwendungszweck: **analoges Modem**
intended purpose:

den grundlegenden Anforderungen des § 3 und den übrigen einschlägigen Bestimmungen des FTEG (Artikel 3 der R&TTE) entspricht.
complies with the appropriate essential requirements of the FTEG (Article 3 of R&TTE) and the other relevant provisions.

Harmonisierte Normen: Gesundheit und Sicherheit gemäß §3 (1) 1. (Artikel 3 (1) a))
Harmonised Standards: Health and Safety requirements contained in §3 (1) 1. (Article 3 (1) a))

EN 60 950: 1992 +A1: 1993 +A2: 1993 +A3: 1995 +A4: 1996 +A11: 1998

Harmonisierte Normen: Schutzanforderungen in Bezug auf die EMV §3 (1) 2, Artikel 3 (1) b))

Harmonised Standards: Protection requirements with respect to EMC §3 (1) 2, (Article 3 (1) b))

EN 55 024: 1998 Teile/parts: EN 61 000-4-2,3,4,6,
EN 55 022: 1998 +A1 :2000 Teile/parts: EN 61 000-3-2,3

Schnittstellenspezifikation: Netzabschluß eines öffentlichen Tk-Netzes
Interface specification: Termination point of a public telecom. network

Spezifikation **TBR 21**
specification:

Diese Erklärung wird verantwortlich abgegeben durch:
This declaration is submitted by:

Aachen, 24. Juli 2002
Aachen, 24th July 2002

Heiko Harbers
Vorstandsvorsitzender
CEO

6.4

Warranty conditions

The devolo AG warranty is given to purchasers of devolo products in addition to the warranty conditions provided by law and in accordance with the following conditions:

1 Warranty coverage

- a) The warranty covers the equipment delivered and all its parts. Parts will, at devolo's sole discretion, be replaced or repaired free of charge if, despite proven proper handling and adherence to the operating instructions, these parts became defective due to fabrication and/or material defects. Alternatively, devolo reserves the right to replace the defective product with a comparable product with the same specifications and features. Operating manuals and possibly supplied software are excluded from the warranty.
- b) Material and service charges shall be covered by devolo, but not shipping and handling costs involved in transport from the buyer to the service station and/or to devolo.
- c) Replaced parts become property of devolos.
- d) devolo is authorized to carry out technical changes (e.g. firmware updates) beyond repair and replacement of defective parts in order to bring the equipment up to the current technical state. This does not result in any additional charge for the customer. A legal claim to this service does not exist.

2 Warranty period

The warranty period for this devolo product is three years. This period begins at the day of delivery from the devolo dealer. Warranty services carried out by devolo do not result in an extension of the warranty period nor do they initiate a new warranty period. The warranty period for installed replacement parts ends with the warranty period of the device as a whole.

3 Warranty procedure

- a) If defects appear during the warranty period, the warranty claims must be made immediately, at the latest within a period of 7 days.
- b) In the case of any externally visible damage arising from transport (e.g. damage to the housing), the person carrying out the transportation and the sender should be informed immediately. On discovery of damage which is not externally visible, the transport company and the sender are to be immediately informed in writing, at the latest within 3 days of delivery.
- c) Transport to and from the location where the warranty claim is accepted and/or the repaired device is exchanged, is at the purchaser's own risk and cost.
- d) Warranty claims are only valid if a copy of the original purchase receipt is returned with the device. devolo reserves the right to require the submission of the original purchase receipt.

4 Suspension of the warranty

All warranty claims will be deemed invalid

- a) if the label with the serial number has been removed from the device,
- b) if the device is damaged or destroyed as a result of acts of nature or by environmental influences (moisture, electric shock, dust, etc.),
- c) if the device was stored or operated under conditions not in compliance with the technical specifications,
- d) if the damage occurred due to incorrect handling, especially to non-observance of the system description and the operating instructions,

- e) if the device was opened, repaired or modified by persons not contracted by devolo,
- f) if the device shows any kind of mechanical damage,
- g) if the warranty claim has not been reported in accordance with 3a) or 3b).

5 Operating mistakes

If it becomes apparent that the reported malfunction of the device has been caused by unsuitable hardware, software, installation or operation, devolo reserves the right to charge the purchaser for the resulting testing costs.

6 Additional regulations

- a) The above conditions define the complete scope of devolo's legal liability.
- b) The warranty gives no entitlement to additional claims, such as any refund in full or in part. Compensation claims, regardless of the legal basis, are excluded. This does not apply if e.g. injury to persons or damage to private property are specifically covered by the product liability law, or in cases of intentional act or culpable negligence.
- c) Claims for compensation of lost profits, indirect or consequential detriments, are excluded.
- d) devolo is not liable for lost data or retrieval of lost data in cases of slight and ordinary negligence.
- e) In the case that the intentional or culpable negligence of devolo employees has caused a loss of data, devolo will be liable for those costs typical to the recovery of data where periodic security data back-ups have been made.
- f) The warranty is valid only for the first purchaser and is not transferable.
- g) The court of jurisdiction is located in Aachen, Germany in the case that the purchaser is a merchant. If the purchaser does not have a court of jurisdiction in the Federal Republic of Germany or if he moves his domicile out of Germany after conclusion of the contract, devolo's court of jurisdiction applies. This is also applicable if the purchaser's domicile is not known at the time of institution of proceedings.
- h) The law of the Federal Republic of Germany is applicable. The UN commercial law does not apply to dealings between devolo and the purchaser.